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Fig. 1—A line parallel to the ideal frame center line is established by sighting through the cylinder with a telescope

Optics in Locomotive Repair

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German Railroad adopts a new way of lining up locomotive frames

WITH steady growth in the size of locomotives, the work of lining up the running gear has more and more assumed the character of a surveying job. In its length dimensions, at any rate, a large modern locomotive exceeds a good-sized dwelling house, such as builders commonly lay out with the aid of a surveyor's transit. When speed is a consideration, moreover, optical survey lends itself to a higher degree of accuracy than is possible with purely mechanical tools. Following a train of reasoning of this kind, in its quest for cutting the cost of rolling-stock maintenance and repair, the German Railroad Company broke tradition and ordered the general introduction of the opto-mechanical aligning method and equipment to be described.

The basic idea underlying the new method is to establish the principal center lines crosswise and lengthwise of the engine frame by optical survey, and then to find the positions of the axle bearings and crosshead guides from these lines by a simple process of mechanical gaging. A characteristic of the new method is the small size and weight of the equipment, any part of which can be easily carried and handled by a single man. In those shops of the German Railroad Company, where the method is now in use, two men completely line up a locomotive frame in less than half the time formerly required by a crew of six working the traditional straightedge-and-square way.

Principal Features of Equipment

The optical part of the equipment comprises but two items, namely, a special surveying telescope, and a collimator or "optical paralleler." What may be called an optical accessory is an adjustable "spotting scale," which is used with the telescope similar to the reading staff in ordinary surveying.

The telescope is seated in the cylinders in steam locomotives, and is used in combination with the spotting scale and the collimator for finding the real, or actual, and the ideal, or true, cylinder bore axis and the perpendicular thereto representing the main driving wheel axis.

These optical parts are complemented by a purely mechanical gaging equipment consisting of a gage bar and stand for use in connection with the collimator in finding the main driving wheel axis, and by several end rods, special dial gage tools, and accessories for determining the lengths along and distances from the lines which have been laid down by the optical equipment.

The principal outward features of the telescope are seen in Fig. 1. The instrument, which is of extra sturdy design, is centered in the bore of steam locomotive cylinders by two expanding

Note: An article by Oliver P. van Steewen (*AM*—Vol. 76, page 35) described a device for reconditioning locomotive frames, making use of an optical system for lining up the frame assembly, by one of the shops of the German Railroad Company. The Zeiss Works have called attention to the fact that the method and equipment employed were originated by them and are covered by their patents. They state, moreover, that while only two devices of this kind were built, the optical process has been incorporated in an opto-mechanical method which has been adopted by the German Railroad Company for general use in its repair shops.

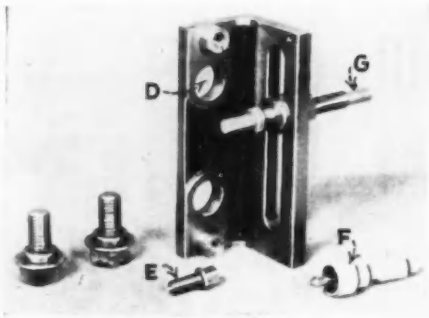


Fig. 2—Gage point angles, such as shown, are fastened near the solid jaw of each pedestal

spiders, or by a spider and collet. The external tube *A*, seen in the illustration, carries inside it a second tube with the optical system. This internal tube is pivoted in a spherical socket around a center, registering in the front plane of the cylinder bore, and can be swung around this center vertically or horizontally by turning two micrometer barrels *B* and *C*. When both barrels register zero, the inner tube is coaxial with the outer tube and hence with the bore.

A preliminary operation is that of attaching a "gage point angle" near the solid jaw of each pedestal. These angles, Fig. 2, are each fastened to the frame by a single capscrew through one of the two holes *D*, and are held against displacement by two setscrews *E* seating in prickmarks made with self-centering punch *F*. The threaded stud *G*, of which the ends form the "gage points," is of a uniform specified length, and is vertically adjustable to bring it into the horizontal plane of the cylinder centers.

The survey is started by calipering the width of the frame across pedestal cheeks at the first and last axle openings. The spotting scale is then clamped to the nearest and to the farthest pedestal as in Fig. 3, and with the telescope on zero, the reading is taken each time. The difference, divided by the distance between pedestals, is the angular error by which the cylinder bore misses being parallel to the side of the locomotive frame.

This angular measurement is now added to or subtracted from the "taper" previously found existing in the frame, the telescope inner tube set to the resultant angle by means of horizontal micrometer *B*, Fig. 1, and the scale sighted a second time for spotting a line of centers through the pedestal jaw faces. For this purpose, the spotting scale carries in the end of the slidable bar a prick punch *H*, Fig. 4, which can be set to the nominal pedestal face center distance relative to the scale. By getting the scale mark corresponding to this measurement under the telescope line cross in each pedestal and striking the punch a blow, a line of spot marks through the pedestal faces parallel to the frame center line automatically results. These marks are transferred to the pedestals on the opposite side of the frame by means of the spotting bar of Fig. 5. The resultant center-to-cheek distances of the different pedestal jaws on both sides of the frame show the

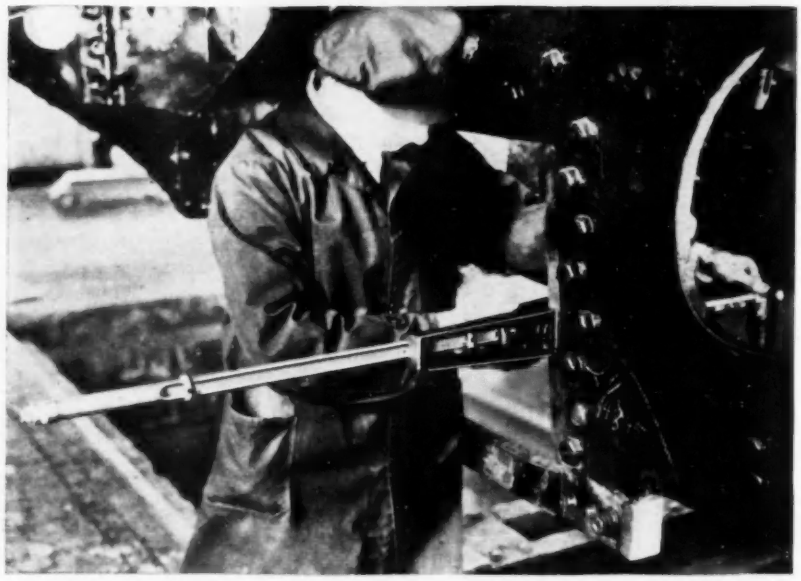
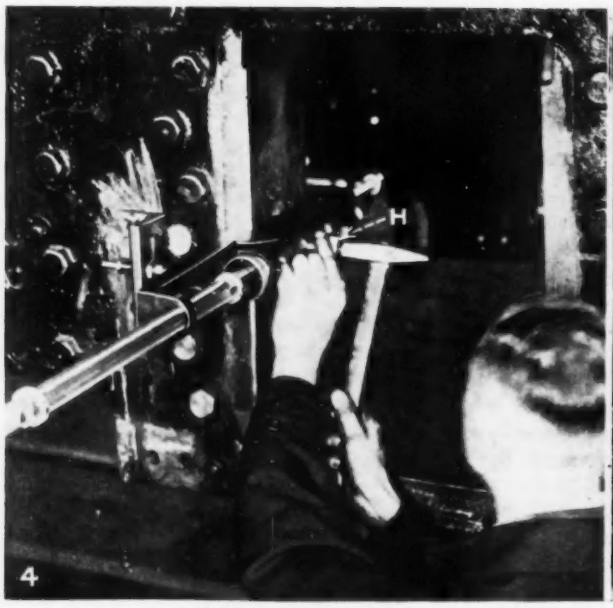


Fig. 3—Readings taken on the spotting scale with the telescope gives the angular error between the cylinder bore and the side of the frame



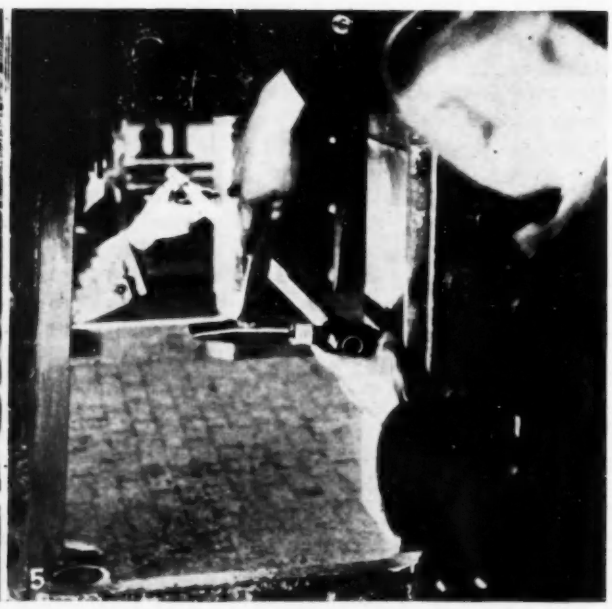


Fig. 4—Pedestal centers are marked with the spotting scale using the center punch *H*. Fig. 5—Pedestal center marks are transferred to the opposite side of the frame by means of a spotting bar

Fig. 6—Alignment is assured by the collimator, an instrument that converges parallel lines to a single focal point. Fig. 8—When the axes of the collimator and telescope are parallel, their cross lines appear in coincidence

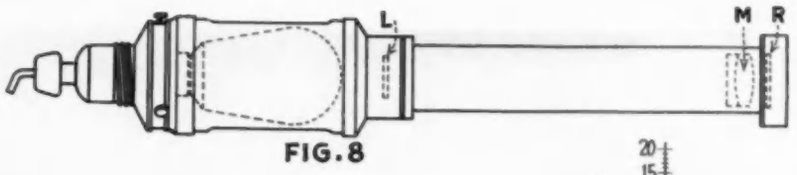
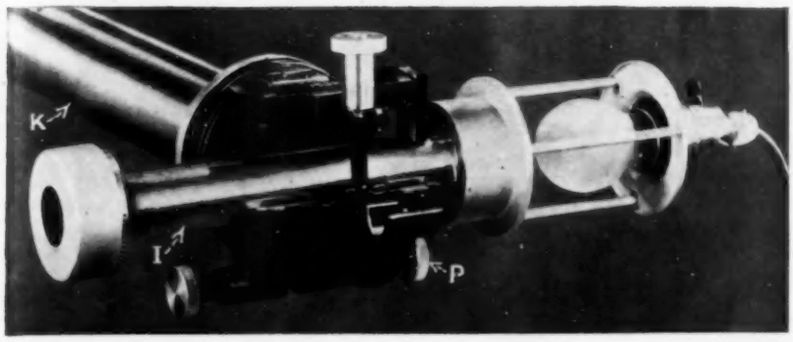
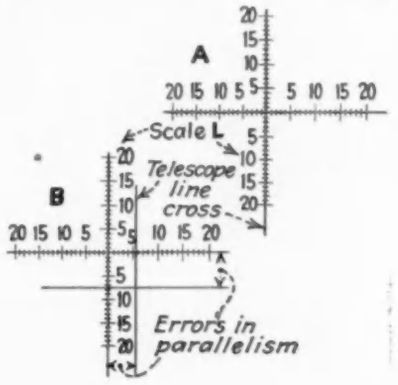


FIG. 8





amounts which must be allowed on each axle box laterally to bring it in line parallel to the frame center plane.

Longitudinal Measurements

In regard to the lengthwise dimensions, the optical process consists in establishing a line at right angles to the previously found frame center plane. This is rapidly accomplished at high accuracy by the use of collimator *I* in combination with the gage bar *J* and stand *K*, Figs. 6 and 7.

For the benefit of readers not familiar with optics, it may be stated that a collimator is an optical device for converging parallel lines of sight to the same focal point. In viewing the scale *L* in the focal plane of lens *M* through the telescope, therefore, the hairline intersections of the collimator scale and telescope will appear in coincidence as at *A*, Fig. 8, whenever the optical axes of both instruments are parallel, irrespective of how far, within the diameter range of the collimator lens, these axes are apart. On the other hand, the line intersections will appear out of coincidence as at *B* whenever the optical axes are at an angle, even if the telescope axis should point exactly at the center of the collimating scale.

For establishing the driving axle center line square to the ideal frame center plane, the collimator is clipped to a V in the swiveling head of gage bar *J*, and thereby automatically registered at right angles to the bar axis. Bar *J* in turn is clamped in a V on slide *N* in stand *K*, which is roughly set to the approximate position of the driving axle along bridge *O*. If, in looking through the telescope, the collimating scale cross appears centered under the telescope line cross, as at *A* in Fig. 8, then the collimator and telescope are parallel. If such a conicidence existed right at the beginning, it would of course be purely accidental, and the image will, therefore, in almost all cases be as at *B*. Correction to the showing at *A* and hence to parallelism is effected by tilting the collimator and V-head in the vertical plane with tangent screws *P*, and swinging the stand column in the horizontal with tangent screws *Q*.

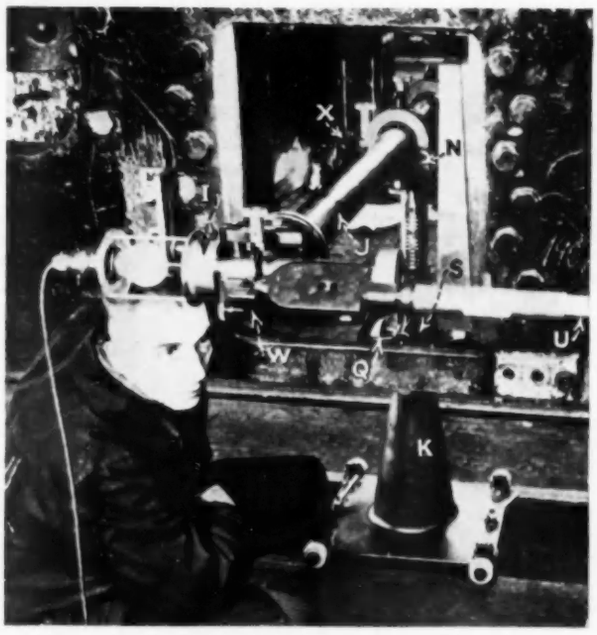
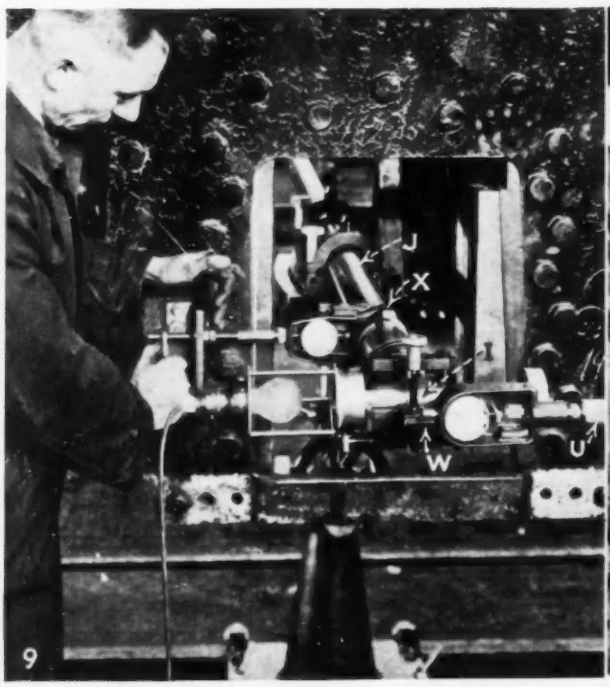


Fig. 7—By bringing the collimator into parellelism with the cylinder bore, the gage bar is made to coincide with the driving wheel axes

In the front end of the collimator is a second cross scale *R*, which being ahead of the optical system, simply acts as a plain target. By focusing the telescope on this non-collimating scale, the amounts are seen by which the gage bar must be slid axially and raised or lowered by handwheel *S* to bring the two optical axes into coincidence. Only roughly approximate coincidence is necessary, although exact coincidence can be easily obtained.

This finishes the optical survey of the frame proper. The remaining operations are of a mechanical nature. They consist in spacing away the gage bar from the engine cylinder face into the vertical plane of the main driving axle axis and in establishing the true positions of the remaining axles. With the front face of its bottom leg, the telescope registers by a machined surface against a strap *T* clamped across the cylinder opening as in Fig. 1, while at its outlook end, it bears a collar with an ear and registering pin for the reception of one end of a dial gage rod *U*, of which the other end is similarly seated in an ear *W* on the V-head.

By trying with the rod as in Fig. 7, the dial gage registers the plus or minus amount which the gage bar lacks of being in the plane of the driving wheel axis. This difference is compensated for by traversing the gage bar head with handwheel *X* until the dial gage registers zero, and the gage bar axis is there-



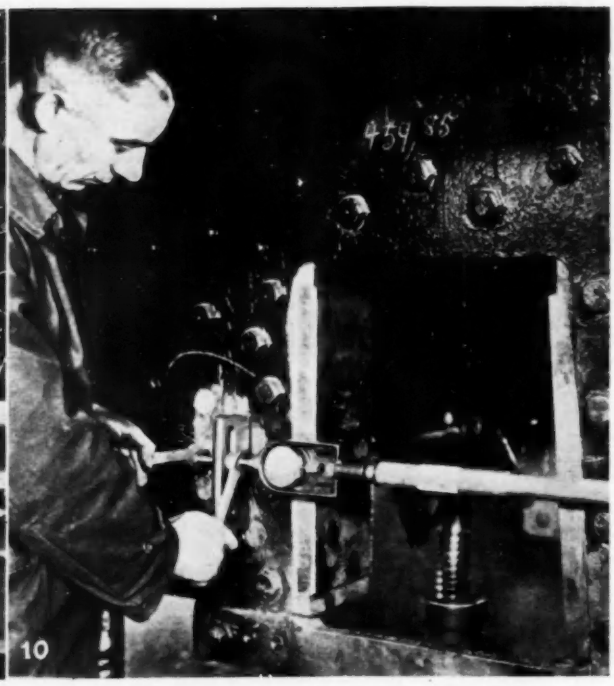


Fig. 9—A special dial indicator is employed to set the gage points on both sides of the frame. Fig. 10—Other longitudinal measurements are gaged mechanically from the points set as shown in Fig. 9

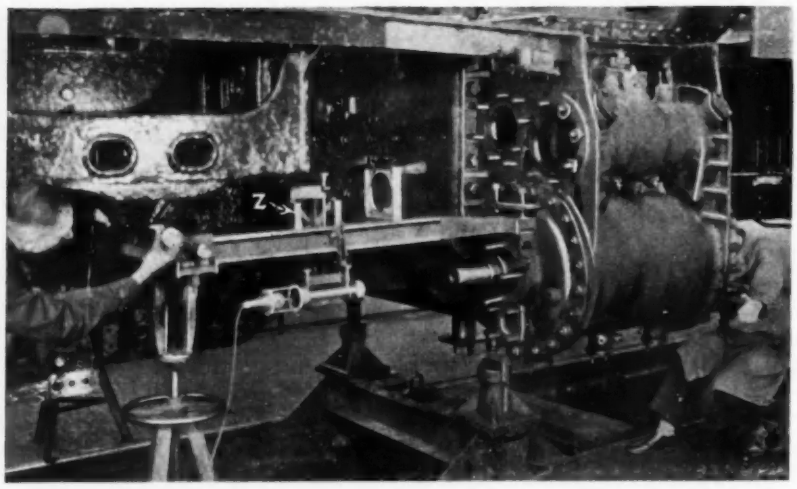


Fig. 11—In setting crosshead guides, the collimator is again brought into service

fore actually in the plane of the main driving wheel axis.

The gage studs on the frame back of the gage bar are next set by applying special dial gage *Y* to one and the other side of the gage bar as in Fig. 9. This operation brings this pair of gage points into a vertical plane exactly at right angles to the ideal frame center line and at a fixed distance from the driving wheel axis. Corresponding adjustments of all remaining gage points relative to their axles are then easily made from this first pair with the aid of an additional end-gaging rod in the manner indicated in Fig. 10.

With the gage studs set and the center marks previously made on the pedestal faces, fixed points now exist from which all measurements transversely as well as lengthwise of the frame can be readily derived for grinding the pedestals and machining the axle boxes.

Setting the Crosshead Guides

The method of setting the crosshead guides with the aid of the cylinder telescope and collimator is seen in Fig. 11. For this operation, the telescope inner tube is centered, and the collimator clipped to a V-bracket. This bracket is registered on the crosshead guide surfaces by interchangeable blocks *Z* to bring the collimator axis into the theoretically correct position relative to the actual cylinder axis represented by the line of sight of the telescope.

As in the case of the gage bar, the rear collimator scale is viewed first, and the guide moved until the two scale centers coincide, indicating that the collimator axis and hence the crosshead guide are parallel to the cylinder axis. The telescope is now focused on the front scale, to show the amounts by which the crosshead guide must be moved up or down or shifted laterally to place it at the correct distances relative to the cylinder.

Checking and Adjusting Optical Elements

Although derangement of the two optical elements is not likely to occur, provision exists for instantly verifying and correcting them whenever necessary. To check the telescope, it is turned in the cylinder to four positions each about 90 deg. apart. If the four positions give the same reading, then the telescope is properly adjusted. Any discrepancy is corrected by turning two sunken screws.

The collimator is similarly checked by turning it to four positions in the gage bar V or crosshead bracket while viewing the rear scale through the telescope, and is corrected in the same manner as the telescope by turning two sunken screws.

The method is adaptable to steam and electric engines of every description. Steam locomotives with inclined cylinders are surveyed with the aid of the prism attachment on the outlook end of the telescope. A special design of telescope is used for work on electric locomotives. The equipment and procedure in these cases otherwise remain essentially the same as described.

Up to Industry

DONALD B. RICHBERG
General Counsel, National Recovery Administration

THE QUESTION is frequently asked, sometimes in hope, sometimes in fear, often in frank skepticism: "What is the National Recovery Administration trying to do?" At the outset of an effort to answer in part that question, let me state some of the things that we are not trying to do:

We are not trying to establish public management of private business.

We are not trying to fix prices or wages by governmental orders.

We are not trying to unionize labor by federal command.

On the other hand, we are not seeking merely to encourage a brief business boom without any effort to control the forces of eventual disintegration, which brought about the depression—and which, if uncontrolled, still menace the security of the American people. In a word, we are not trying to revive the "Follies of 1929."

Some stubborn minds may yet have learned no lesson from the World War, from the following years of intoxicated expansion of credit and from the later years of deadly payment of our debts. But to most people has come some realization of the fact that an era has ended, that new occasions now impose new duties and that a new generation cannot rely wholly on the wisdom of its fathers.

Objects of the Act

The objects of the National Industrial Recovery Act are well understood and universally approved. They are: to put more people to work; to give them more buying power; to insure just rewards for both capital and labor in sound business enterprises, by eliminating unfair competition. To accomplish these high purposes the National Recovery Administration is being organized in Washington as a machinery of cooperation between industries and the government.

An address delivered at luncheon of the Merchants' Association of New York, held July 6, 1933, at Hotel Astor, New York City.

This statement represents the attitude of the National Recovery Administration. No matter what you think of the Recovery Act, the men who are administering it, or the way they are administering it, you will do well to read what their general counsel has to say. It contains a warning expressed in no uncertain terms

The success of this Administration will not depend upon transforming private business into a public utility service under public control. That is not the design of the law or of those who have been chosen to administer it. The success of this great adventure will depend largely on the ability of the managers of private business to accept a new opportunity for self-government in industry. They can now substitute enlightened cooperation in promoting the general welfare, for a cannibalistic struggle to survive by eating their own flesh and blood.

If this adventure should fail, it will not be a failure of government; it will be the failure of an industrial system which the Industrial Recovery Act seeks to improve in order that its values may be preserved. It will mean, either that the system is fundamentally unsound, or that the present managers of private industry are incapable of operating it successfully.

In his statement of June 16th the President said that this law is a challenge to industry and to labor. That challenge must be met in the next sixty days. If the organized groups of either management or labor fail to meet that challenge they will be indicted for incompetence by the suffering millions who are now giving to industrial leadership one more chance—perhaps the last—to justify its authority.

This is no time for men who have positions of power and large influence in shaping the policies of commercial, financial or labor organizations, to hold back, either to placate hesitant minorities or to serve selfish special interests. The forces of the depression have not been conquered merely by a rise in commodity prices or in the market quotations of stocks and bonds. We have still millions of men and women out of work; we are spending millions of dollars every day to keep these unemployed masses and their dependents from starvation.

In this great emergency—when the whole power of the federal government is being exerted to give business men an opportunity to organize for a united drive to reemploy the workers, and to pay wages sufficient to provide a market for industrial and agricultural products; when protection against the unfair competition of over-worked, underpaid labor is assured; when the legality of cooperative action is assured—there can be no honorable excuse for the slacker who wastes these precious moments with doubting and debate—who palsies the national purpose with legalistic arguments and appeals to prejudice.

Constitutional Questions

As the legal adviser of the National Recovery Administration let me indicate in a brief space the futility of a debate over questions of constitutional law in this critical situation.

First, there is no change of any provision of the Constitution attempted in this law. Therefore, all the time-honored constitutional rights of the individual remain unmodified by this law.

Second, there exists no constitutional right to do anything which is forbidden by this law. There is no constitutional right to compete unfairly; and there is no business competition which is more unfair or more harmful to all the people than the competition of low wages and long hours, which the National Recovery Act seeks particularly to eliminate.

The welfare of all the people and the prosperity of all business is undermined by such competition, out of which only a small minority can make a temporary profit. If the Constitution protected the right of a few to profit in such a manner at the expense of all the people, it would be a charter of anarchy and not a bulwark of law and order. In truth, the Supreme Court has repeatedly held that the Constitution does not authorize any such minority veto upon a code of business morality approved by the overwhelming majority of the people.

Third, if any man fears that, in the establishment of a law of fair competition, he may be deprived of some constitutionally protected freedom of action, his present course should be clear. Let him first join with his fellows in writing the rules of the game before protesting that he is sure the rules will be unfair. Let him then try to play the game according to the rules, which may be a novel but perhaps an educational experience for many who have been accustomed to dignify lawless self-assertion and disregard for the rights of others, with such noble words as "individualism" and "liberty."

Finally, constitutional rights are not invaded by proclamations, or statements of public policy, or even by grants of extraordinary power to meet extraordinary needs. They are invaded only by the exercise of force to take from a man a liberty or a property right, of which he may not be lawfully deprived. Let me say now and emphatically that the National Recovery Administration expects to operate so far inside the boundaries of constitutional power that judicial determination, even of borderline cases, will not be necessary. But, if the learned members of my profession (in which two opinions can always be obtained) feel at any time that the Administration has erred, the courts, zealous to protect liberty and property, are always open—and they are the final arbiters of what may or may not be lawfully done. Why bring that up now?

Aims of the Administration

Returning to the question propounded at the outset—let me summarize what the National Recovery Administration is trying to do today.

Every substantial industry in the country is being urged to prepare and to submit promptly a basic code of fair competition. This code should provide for such a shortening of the hours of labor as will bring about the immediate reemployment of the number of men normally attached to the industry. This code should establish minimum wages for the hours of work as limited, so that a decent living may be assured to the humblest worker. This code should contain also the mandatory provisions of Section 7a of the Act, protecting the rights of self-organization and collective bargaining for all employees.

This basic code may contain other provisions, regarded by the sponsors as essential to eliminate unfair practices and to increase the stability and security of sound enterprises operating in conformity with the code. But it is highly desirable to avoid submitting immediately those comprehensive codes which will deal eventually in greater detail with trade practices and competitive methods and relations. Speed and mass action are essential to meet the far-reaching needs of the immediate future.

We cannot wait to hold adequate hearings upon complicated codes concerned with the intimate problems of particular industries. The ability of each industry to increase employment, to add to its payrolls, depends in large measure upon concerted action. There must be a united attack of all industries upon low wages and long hours, a simultaneous rise of purchasing power all along the line. The new buying power created by the increased payrolls of each industry will help to absorb the products of all the others.

First Things First

Faced by this demand for speed, we must follow the President's policy of doing the first thing first.

The recent public hearings on the code submitted by the Cotton Textile Industry have helped to make plain the method and objectives of the Administration. A basic code, simple in form and comparatively brief, was presented; and in it was laid the groundwork for a future more comprehensive code. The schedule of maximum hours of work for men and for machines, and the schedule of minimum wages, did not provide precedents for any other industry. But the method of arriving at these schedules was significant.

Here is an industry which has been historically operating long hours on a low wage level. Naturally low prices for its products have followed upon the competition in low operating costs. Any revolutionary increase in costs would require a revolutionary increase in prices, with drastic and uncertain consequences to an industry markedly competitive within itself and with other industries. All these factors had to be weighed by the industrial representatives assisted by the impartial services of our government agency. In the end, a brief basic code drafted by the textile operators offered four changes in industrial practice which are of startling consequence: (1) Abolition of child labor; (2) Substantial reduction of the hours of labor in this industry to two shifts of 40 hours per week; (3) Increase of minimum wages to the purchasing power level of wages for the longer hours of 1929; (4) Limitation of machine hours to 80 hours per week, checking overproduction, eliminating the "graveyard" shift at night and giving to rural enterprises some protection against excessive operations in the urban mills.

It Can Be Done

The Administrator, who may suggest further revisions, has not yet recommended this code to the President, whose approval must be finally obtained. But it should be very clear that the code to be ultimately adopted will not be in any sense the product of a dictatorship. It will represent the uncoerced desire of this industry to govern itself wisely and in the public interest. Enough has been accomplished already, in thus dealing with one industrial problem of exceptional difficulty, to demonstrate both that this job can be done and that it should be done. If the cotton textile code were approved as written, it would mark a great forward step in this industry.

Guided by its experience with this first code, the National Recovery Administration can assure other industries of early and practically simultaneous action. Several separate public hearings can be conducted at once—now that our procedure has been established and found serviceable. Consolidated hearings may well be held upon codes affecting related industries.

But all that can be done depends right now upon the whole-hearted cooperative efforts of the industries themselves. The Administration cannot and should not undertake to prepare codes. Our field of service is definitely limited until a code is brought in. We should not be expected to arbitrate differences or to seek to bring about the adoption of a code in such a manner as to commit the Administrator to approval of its provisions before the opportunity has been given for public criticism and expression of the views of the various affected interests.

The Function of Government

Above all things, the letter and spirit of the law lays down the function of the government; and it is not that of a dictator or controller of industrial policies; not even that of an arbitrator between parties in conflict. It is the purpose of the Administration: *first*, to aid the representatives of a single industry to achieve the immediate objective of all industry—to put people back to work at decent wages and reasonable hours; *second*, to coordinate the

programs of the various industries for the accomplishment of this common objective; *third*, to protect and promote the general welfare in all phases of this industrial self-government; and *fourth*, to maintain such a supervision over the future use of those cooperative powers which may now be exercised for the benefit of industry, as will make sure that those powers will not be abused but will be utilized in a manner consistent with the public interest.

It may be observed that this ambitious effort to encourage the intelligent planning of industrial activities calls for the collection and analysis of economic data both by trade and industrial groups and by the Recovery Administration. This utilization of scientifically gathered and organized information as the basis for business policies, this intrusion of trained and impartial economists into the councils of business, may be viewed with alarm by many sturdy and self-sufficient business men. "Book learning" is sometimes the scorn of those who would protect their self-assurance from the disturbing knowledge that their favorite ideas have been tried and found wanting many times and in many places.

Consorting With Professors

Doubtless there are hundreds, perhaps thousands of manufacturers, merchants and distributors who will be a bit uneasy at the throught of conferring in trade associations and in government offices with men who have actually spent years reading in libraries, or even writing books, and trying to devise ways and means to substitute careful planning for reckless guessing in the guidance of industrial operations. Even a cold-blooded advocate of a planned economy should sympathize deeply with a business genius whose momentous decisions have heretofore been based on reasoning akin to throwing the dice or tossing a coin, and who is now asked to abandon this stimulating exercise of individual initiative and to resort to the study of mystic charts and tables prepared by some educated pencil pusher.

Nor should we ignore the agony of the hard-headed manager who has stood on his head successfully all his life, viewing the supreme achievement of a business enterprise as a reduction in the payroll coupled with an increased output, who has not felt the slightest responsibility for maintaining mass purchasing power, and who is now suddenly asked to stand on his feet and, when no longer looking at the world upside down, to observe that employees are really customers and that the supreme achievement of a business enterprise may be to pay out as much money as possible in wages without producing more goods than the market will absorb.

We must all recognize and sympathize with the profound difficulty of adjusting the habits and prejudices of a lifetime to the requirements of a national emergency. The times demand not only courage and sacrifice but also intelligent action based on an understanding that the causes of the depression lie "not in our stars but in ourselves."

Faith in the Business Man

The National Industrial Recovery Act was written in the confident belief that the great majority of business men are ready to take intelligent action, to accept their responsibilities courageously, and to cooperate with their fellows and with their government in accomplishing the purposes of this law.

One of the primary purposes of the law is to avoid any necessity for government control of business; to encourage private initiative, to rely on self-discipline; to put faith in voluntary, collective agreements as the means of fixing and stabilizing human relations in and between units of industry. It will be only the failure of our industrial leadership to accept its great opportunity for self-service combined with public service, which may bring into play and make necessary the exercise of those reserved powers of government which are described as dictatorial, but which are in fact only powers of self-preservation.

If my brethren of the bar will read again certain opinions of the Supreme Court, they will find there written down that the supreme law of government, as of the individual, is the law of self-preservation. A government sworn to protect and to defend the Constitution cannot permit that Constitution to be used as a shield for the enemies of constitutional government. The constitutional right of individual liberty cannot be made a shield of anarchy. The constitutional right of private property cannot be made a shield of tyranny and oppression.

The Choice

There is no choice presented to American business between intelligently planned and controlled industrial operations and a return to the gold plated anarchy that masqueraded as "rugged individualism." There is only the choice presented between private and public election of the directors of industry. If the privately elected boards of directors and the privately chosen managers of industry undertake their task and fulfill their responsibility, they will end all talk of dictatorships and governmental control of business. But if they hold back and waste these precious hours, if they take counsel with prejudice and doubt, if they fumble their great opportunity, they may suddenly find that it has gone forever.

It is not my faith that the managers of industry should be chosen by popular ballot. No man to my knowledge who had an active part in drafting the National Recovery Act, or will play an active part in its administration, is seeking the political socialization of industry. But unless industry is sufficiently socialized by its private owners and managers so that great essential industries are operated under public obligations appropriate to the public interest in them —the advance of political control over private industry is inevitable.

The great adventure of the Recovery Act lies in this effort to find a democratic and a truly American solution of the problem that has produced dictatorships in at least three great nations since the World War.

In this great adventure the Administration has invited, and will seek to merit, the confidence and cooperation of leaders of industry and of every phase of American life. We have no panaceas that must be accepted, no patent medicines that must be swallowed, no rigid theories that must be adopted. We have only the earnest desire to carry forward the program of the President in the light of his vision and under his guidance, to the end that the institutions of democratic control may be preserved in government and in business—each in its separate sphere—and each in cooperation with the other.

Sensible Tolerances
Discussion

E. NORMAN FARRAR
Ipswich, England

John E. Hyler is certainly right when he says in his article under the title given above (*AM*—Vol. 77, page 5), that the reason why the average designer specifies unusually close tolerances is because he wishes to make as certain as possible that his project will be a success. However, I am afraid that I cannot agree with the method Mr. Hyler suggests for widening the tolerances. Judging by my experience with shop men, they would, if asked to comment on the tolerances to be settled in a new design, immediately try to have them made too liberal, with the sole object of reducing the manufacturing costs.

My own suggestion is that when a design has been completed, it should be submitted to the head of the design office who would investigate the proposed tolerances, and would widen them only when his experience tells him that such an alteration could be safely made.

Shells Drawn from Rustless Steel

JOHN J. McHENRY

MANY of us responsible for determining die making and operating costs have realized, though not often admitted, a lack of confidence in our operation analysis and cost determination when dealing with stampings made of rustless iron and steel or of the veneered or rustless clad metals.

A hurried canvass for information, when preparing quotations on parts to be made from these metals, usually adds to our caution. For the consensus of opinion is that dies and presses must withstand unusually severe service, that cutting dies are short-lived, and that the drawing of shells, such as practised by us, was simply not being done. Yet seldom is there shown us concrete evidences of these assumptions.

Now, the increase in applications of stainless is evident, and our knowledge of die construction for stamping and drawing this metal must become more definite through practical trial, interchange of descriptive experience and recommendations from the manufacturers. And, speaking of interchange of ideas through the technical press, how do you reconcile the following?

L. G. Patterson (*AM*—Vol. 75, page 714) commenting on an article, "Relation of Die Clearance to Metal Thickness" (*AM*—Vol. 75, page 495), states in reference to stainless steel "that the punch and die have to be fitted with practically no clearance, even in blanking ⅛-in. metal, or they will throw a burr in proportion to the amount of clearance between the punch and die."

Walter C. Schmidt contributed a most interesting and comprehensive article, "Stampings of Rustless Iron" (*AM*—Vol. 76, page 778). He states, "Die clearance is set at 1½ times that shown in *American Machinist's Handbook* for the hardest cold-rolled stock." He advised twelve per cent of metal thickness. In our plant we built dies with a clearance of eight to ten per cent of metal thickness, and our stampings were perfectly satisfactory. However, die life is vitally concerned with die clearance, and my experience has been that greater clearance prolongs the life of the die.

These different statements are somewhat confusing.

Our plant manager arranged a discussion with representatives of a manufacturer of stainless for the purpose of obtaining reliable first-hand information on die construction and lubrication for stamping and drawing this metal. For stamping dies, a die clearance the same as used for hard cold-rolled steel was recommended. The matter of deep-drawn shells was brought up, especially that of deep-drawn conical or bullet type shell.

For the conical type, they recommended a series of dishing or forming operations, operated progressively until the desired shell was evolved. To me the explanation was most indefinite and from my viewpoint quite impractical. After some discussion, I determined to do my own investigating in this particular instance, and this is described further on.

For deep-drawn cylindrical shells, their recommendations were definite; as to their accuracy, I have had no opportunity to check; but from experience with other metals, I judge them to be conservative.

The recommendation is:

A blank reduction of 40 per cent on the first draw,

A shell reduction of 20 per cent on the first redraw,

A shell reduction of 10 to 12 per cent on following redraws.

For the proper lubrication of drawing shells they recommended the following proportions:

1—gallon emulsifiable oil
1—gallon hot water

Mix into above one to two pounds lithopone. Add one pint to one quart of mineral oil containing two to five per cent sulphur in solution. Mix to the consistency of thin paint. Add lysol or equivalent to kill infection.

For draw rings and die sections, subject to contact with stainless steels, they recommend alloy steels containing twelve per cent chrome and two per cent carbon. This coincided with experience of Mr. Schmidt who recommends for shaving dies steels of high chrome and high carbon.

And now about our personal investigation. Our experimenting was not extensive and was done wholly by practical die and press men to determine by actual trial the relation between the drawing of stainless steels to that of drawing cold-rolled steel. The difficulties encountered were much less than we anticipated. Our experimenting consisted of drawing round and oval pans, and conical or bullet shape shells of from 0.020 to 0.040 in. thickness, and approximately 3 in. diameter by 4 in. long to 10 in. diameter by 11 in. long. Some of these shells required reversing a first drawn pan, and others were drawn without reversing but required a pointing up operation. In every instance, we found it possible to make shells of 18-8, straight 18, or stainless clad on the same dies we used for ordinary cold-rolled steel. The stainless clad and straight 18 required no annealing but did require excessive pressure on our draw rings to hold the shell from wrinkling. This meant changing to presses of greater capacity than used for cold-rolled steel. As to the relation between the strength of presses required, I judge the proper ratio to be in accordance with the steel's ultimate strength.

That of stainless is approximately 100,000 lb. per square in.; that of deep drawing cold-rolled steel is approximately 60,000 lb. per square in.

Frequent Annealing Needed

The 18-8 required not only the same or greater pressure on the draw rings but hardened rapidly, and we experienced much difficulty in getting it through second press operation. A third press operation was impossible without annealing. To anneal we heated the furnace to 2,000 deg. F., the shells were entered without preheating, and quenched in clear water. The third operation then went through nicely. In figuring operation costs, I would plan an annealing operation after the first draw and at least every second draw thereafter.

Another hardening element seldom considered and not so generally known is that shells stopped between draw operations and allowed to stand, even

over night, will harden. Best draw and redraw conditions are experienced when the work runs continuously throughout all operations without interruption. This, I presume might be even more pronounced when working 18-8.

As to shells maintaining the size of the draw dies, there is greater elasticity to this material than to cold-rolled steel. In the case of bullet shaped shells, it is necessary to make the first operations undersize, allowing the final operation to open up the shell slightly. Because of this elasticity, the amount required must be determined by trial, but of one thing you can be sure—unless you include this opening up operation the shell will be larger than the dies that made it.

Special Alloys for Dies

As to how the ordinary dies stand up, ours were promptly and effectively scored and scratched beyond usefulness, thus proving conclusively that draw rings made from close grained cast iron, having ½-1½ per cent nickel, while excellent for cold-rolled steel were useless for 18-8. Similar type irons, known to the trade as chrome-nickel and chrome-vanadium, while showing better resistance to scoring, still were not indicative of being metals capable of standing up under the severe service required. Small draw dies of alloy steel such as Ziv's P.R.K., Carpenter's K.W. and others, showed no extraordinary wear, and I would use them without hesitation until I discovered something better. On materials for large draw dies, I would follow the advice of the manufacturer, for I am satisfied that cast iron, even though alloyed for resistant qualities, would not give satisfactory continuous production on draws of maximum reductions. On draw dies of minor reductions, no doubt a properly alloyed cast iron would work out; however, our actual tests convinced us that we had no such alloy.

Finally, as a result of quite a general tryout on the type of shells described, I am convinced that the greatest difficulties existing in press operations on these steels is the mental attitude of an inexperienced and meagerly informed die and press room, the disposition to operate the tools on presses of minor capacity, and the use of inferior steels in die construction. I would not hesitate to undertake any drawing or forming job with stainless steel that I feel capable of making from ordinary cold-rolled steel.

Press capacity, rugged dies, the manufacturer's cooperation and the practical die and press man's experience should whip any stainless job as thoroughly as though it were the better understood cold-rolled steel.

Simplified Milling Cutter Layout

VICTOR J. SMITH

An approximation to the true parabolic tooth curve will save time. The layout shown is for an 8-in. cutter with 32 teeth; tooth spacing is 11 deg. 15 min.

A parabolic tooth milling cutter may be laid out much more simply than by using coordinate data based on the theoretical curves. The number of teeth used in all cases for any specific diameter is the nearest even number as calculated from the formulas given in A.S.M.E. *Transactions* (Vol. 43, page 577).

The original layouts were made five to ten times size, depending on the diameter and using the coordinate data as given in the above reference. A curve for the back of the tooth was then found that would for all intents and purposes coincide with the theoretical curves.

Methods of Procedure:

1. Draw a circle with the required outside diameter of the cutter.

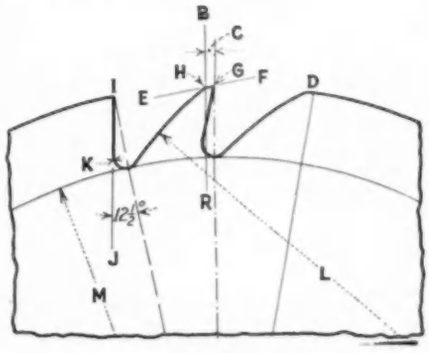
2. Subdivide the circumference of this circle into the number of teeth required. Draw radii to the points *I*, *G* and *D* thus found.

3. Draw a construction circle with a radius *M* representing the root diameter of the gash. This radius is given in the accompanying table.

4. Draw a construction line *RB* at a distance *C* from the radial line through *G;* then draw line *EF* at 5 or 7 deg. to the horizontal and passing through point *G*. The intersection of this line *EF* with line *RB* will be point *H* on the back curve of the tooth required.

5. Draw line *IJ* through *I* at 12½ deg. to the radius through *I;* then draw an arc of radius *K* tangent to line *IJ* and the root circle.

6. The back of the tooth is then completed by drawing a curve with a radius *L* which passes through point *H* and is tangent to the arc of radius *K*.



LAYOUT DATA

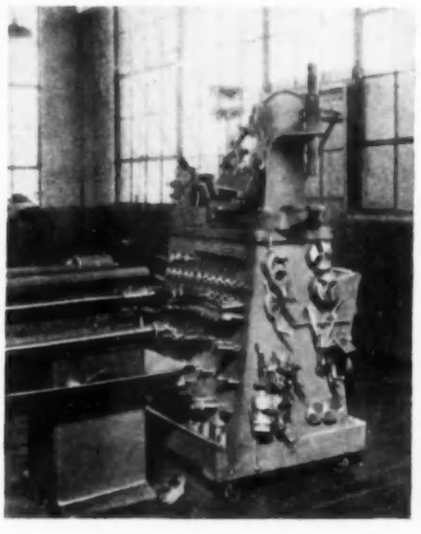
Diameter of Cutter	Number of Teeth	Distance "C"	Radius of Root Circle "M"	Radius of Fillet "K"	Back of Tooth Radius "L"	Circular Pitch
2	14	1/32	49/64	1/32	1 5/32	0.449
2½	16	1/32	31/32	1/32	1 3/16	0.490
2¾	18	1/32	1 7/64	1/32	1 3/16	0.480
3	18	1/32	1 15/64	1/32	1 11/64	0.523
3½	20	1/64	1 27/64	1/64	1 9/32	0.550
4	22	1/64	1 41/64	1/64	1 11/32	0.570
4½	24	1/64	1 55/64	1/16	1 23/64	0.590
5	26	1/64	2 1/32	1/16	1 27/64	0.604
6	28	1/16	2 1/16	1/16	1 31/64	0.673
7	30	1/16	3 1/64	1/64	2 5/32	0.734
8	32	1/16	3 5/32	1/32	2 1/4	0.786

Scaled dimensions from an enlarged layout serve to construct approximate parabolic curves

Rack for Lathemen's Tools

Goddard & Goddard, Detroit, Mich., believe in making it easy and convenient for their men to do their work. They likewise have a leaning toward keeping machines free from tools laid on the bed, and against fixtures and appliances scattered over the floor. So they make it easy to avoid both by providing racks for tools, dogs, clamps and special fixtures. A rack for lathe workers is shown herewith. The size and arrangement can be seen without difficulty. In addition to providing pins or hooks for dogs, collets, adapters and faceplates, the steady rest is kept out of the way and a mandrel press is also provided.

These racks are mounted on substantial casters so as to be easily shifted for cleaning or other purposes. They save a lot of time for the lathe hand by making it unnecessary for him to go to the toolcrib for any of the equipment he is likely to need.



Orderliness in the shop is promoted by a combination arbor press and tool rack

Standards for Production Control—II

ALLEN M. LINDSLEY
Production Engineer,
Metallurgical Laboratories, Inc.

In the last number the author explained the general methods of setting up standards with specific reference to operations on the Fellows gear shaper. This article has to do with hobbing

THE second group of operations for which time standards were developed was the hobbing of gears. The particular machine studied was a No. 5-A Lees Bradner universal machine, which handles a wide range of work, including the hobbing of straight and helical spur gears, the hobbing of worm wheels, and the milling of worms and screw threads. The standards illustrated cover only the hobbing of straight spur gears. It should be noted that the chart shown in Fig. 8 may be used in connection with any hobbing machine, regardless of design or make.

As in the case of the gear shaper, the machine and cutter equipment were put in first class condition so that maximum feeds and speeds could be set to obtain top production. During this investigation, all hobs were checked with the result that a number were discarded for errors in tooth form, and replaced with the newest type of ground hobs. A list of available hobs with important dimensions was made up for the use of the shop and the planning department.

Time studies were made on a representative number of parts of various materials as explained in the first article and condensed into the standards shown. Handling time is given in Fig. 5.

In applying standards for the hobbing operation, it is necessary to find the dis-

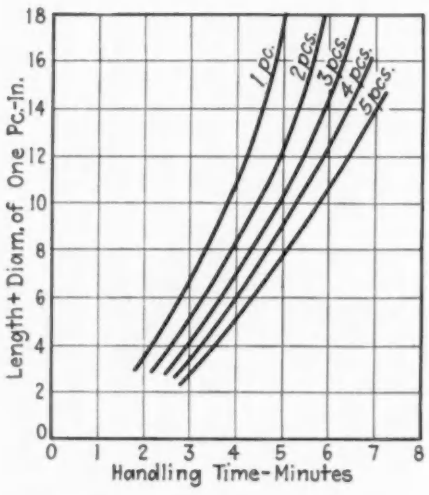
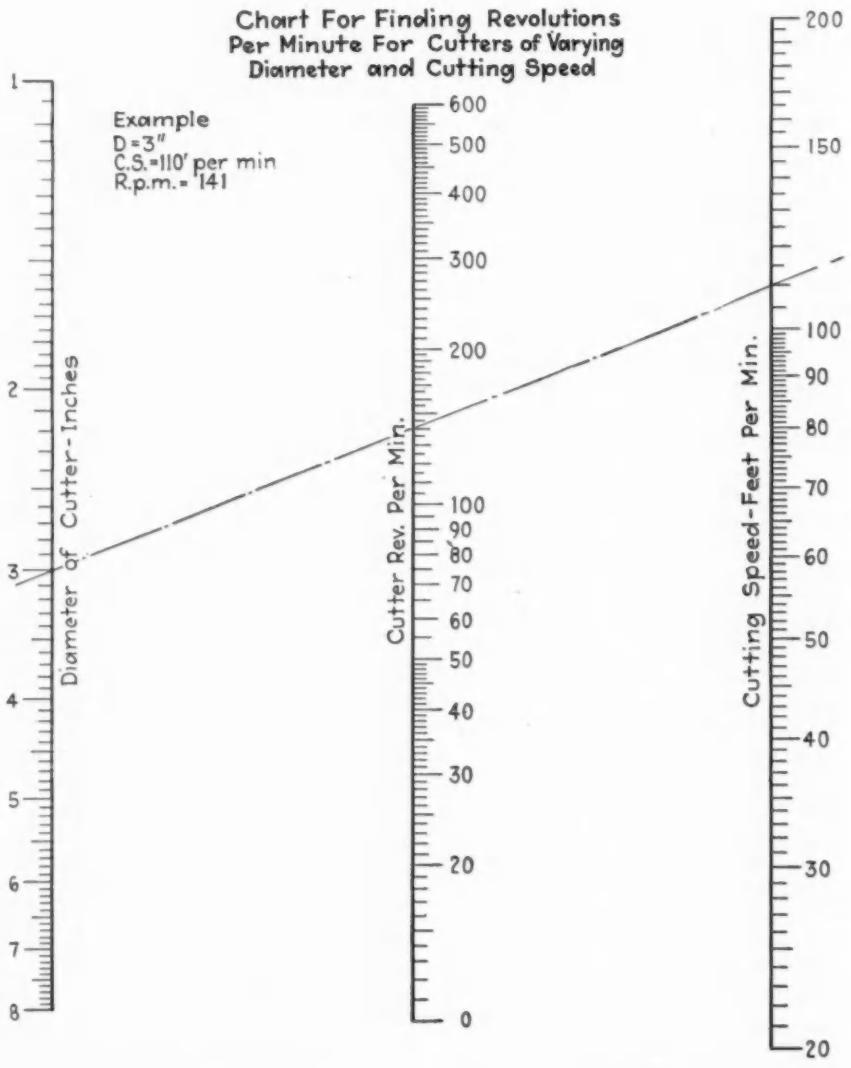


Fig. 5—Handling time for gear hobber. Chart shows total time for one cut. For two cuts with no feed change use curve value plus 1.8 min. For two cuts with feed change use curve value plus 3.2

FIG. 7

Chart For Finding Revolutions Per Minute For Cutters of Varying Diameter and Cutting Speed



tance traveled by the hob before it is cutting to full depth. This distance is called cutter approach and must be added to the over-all length of the gears as chucked in order to find the total length of cut. The cutter approach varies as the diameter of the cutter and depth of cut, and the relation is expressed as $A = \sqrt{E(D - E)}$, where A is cutter approach, E is the depth of cut, and D is outside diameter of the cutter. It is so frequently necessary to find cutter approach in milling slots, face milling, and similar operations, that the chart in Fig. 6 was constructed to find this variable quickly.

It is likewise necessary in hobbing, as well as in lathe work, milling operations, or wherever the work or cutter rotates, to determine the r.p.m. of the cutter or work for a given diameter of work or cutter and a given cutting speed in feet per min. The equation C.S. $= \frac{\pi D \times \text{r.p.m.}}{12}$ expresses the relation between these variables, and the chart, Fig. 7, solves this equation for the convenience of the planning department and the shop.

In explaining the application of the gear hobbing data, it is assumed that a lot of thirty heat-treated, chrome-vanadium gears are to be hobbed. This type of gear is required to be accurate and must stand up under many hours of service without appreciable wear. It is further assumed that the gears are 8-pitch, 1-in. face, 6½-in. outside diameter, have 50 teeth and no hubs.

Because of the extreme accuracy required, reference to the gear hobbing data directs the use of two cuts. Since the quantity required is small, it is not economical to use a roughing hob, requiring additional set-up time, and therefore both cuts are made with the same setting using a single-lead hob. Four blanks may be chucked at one time. A 3-in. diameter ground hob is selected from the hob list. These data call for the use of a cutting speed of 80 ft. per min. for roughing and 100 ft. per min. for finishing a tough alloy steel. A roughing feed of 0.04 in. and a finishing feed of 0.03 in. per revolution of the work are selected by consulting the feed table. By referring to Fig. 7, it is found that a 3-in. hob, to cut at 80 ft. per minute, must revolve at the rate of 104 r.p.m., while for a 100-ft. cutting speed, the r.p.m. of the hob must be 127. Reference to the ma-

FIG. 6

Chart for Finding Cutter Approach

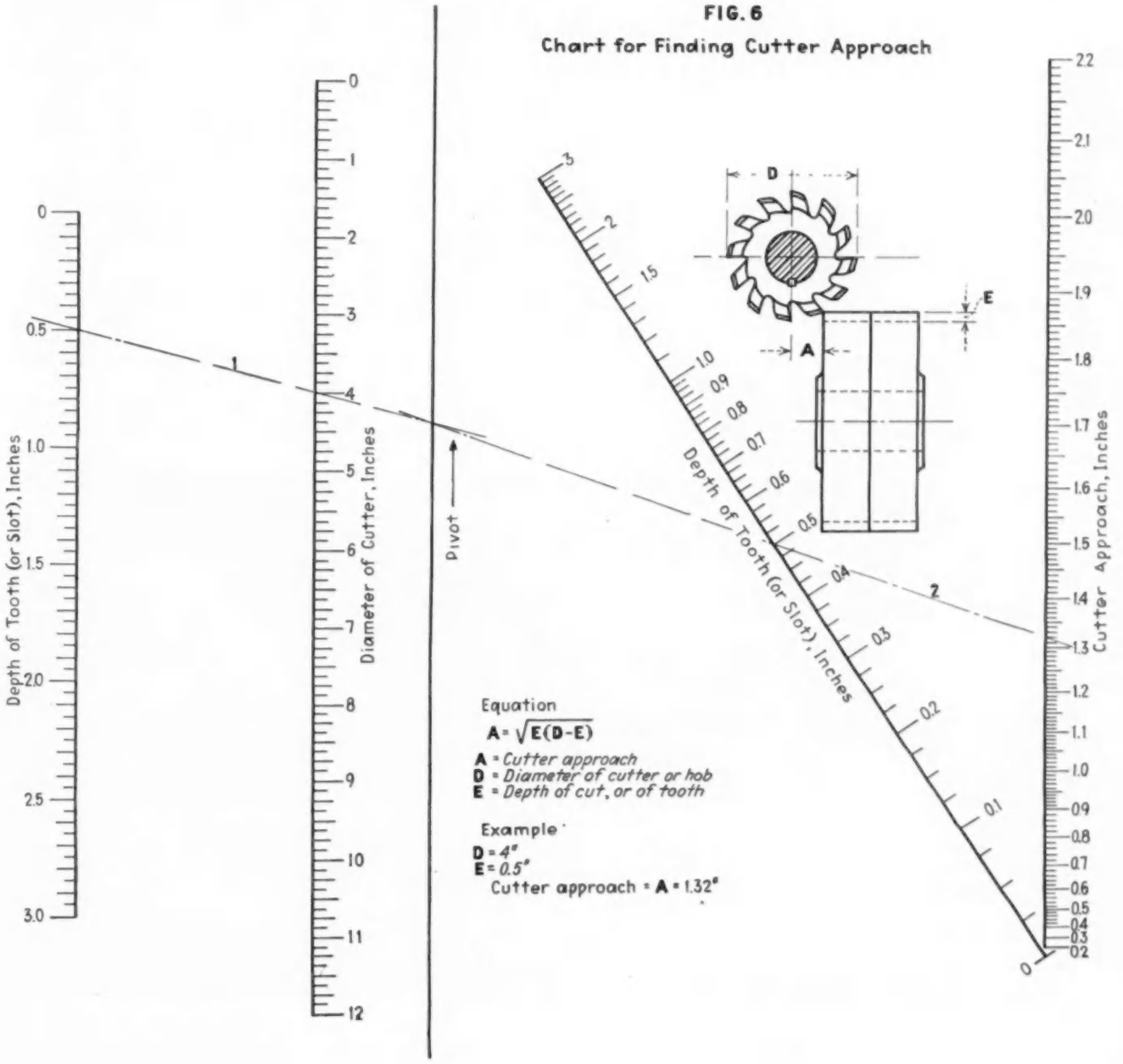
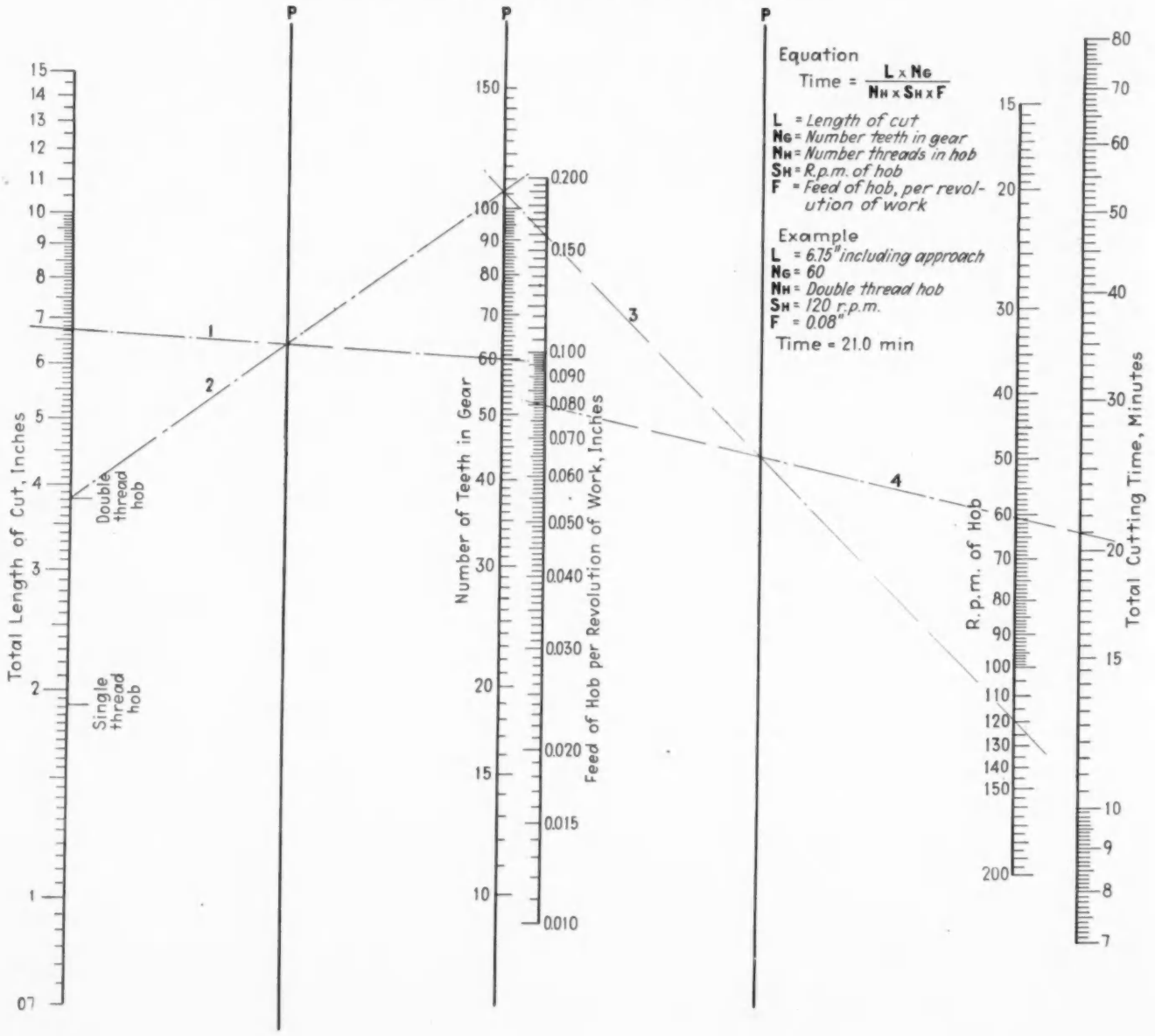


FIG. 8
Chart for Estimating Production on Gear Hobber



Gear Cutting Data

Machine: No. 5-A Lees Bradner gear generator, with auxiliary cutter spindle and worm wheel infeed.

Class of work: High quality, spur and helical gears, worm gears and worms.

Capacity: Spur and helical gears, 4 D.P. in steel, 8-in. face x 14-in. O.D.

Countershaft speed: 360 r.p.m. Driving pulleys: 12 in. O.D. Hp. = 3.

Main cutter arbor: Takes standard hobs 4½-in. O.D. x 1¼-in. hole x 4½-in. max. length; or 5¾-in. O.D. oversize hob; ¼ x ⅛-in. keyway.

Auxiliary cutter arbor: Takes standard hobs 2¼-in. O.D. x ¾-in. hole x 1¼-in. length; or 3-in. O.D. oversize hob; also 3-in. O.D. x 1 in. hole worm milling cutters; $\frac{5}{32}$ x $\frac{3}{32}$-in. keyway.

Table II—Feeds—Straight Spur Gears

1. Quantity production high accuracy and finish: Rough and finish in two settings, using double lead hob for roughing. Pitches 16 and finer: one cut with single lead finishing hob.

2. Small-lot production (30 pieces or less) high accuracy and finish: Rough and finish in same setting, using single lead finishing hob.

3. Commercial accuracy and finish: Use cutting speeds indicated for roughing, and finish in one cut with single lead hob.

Class	Large Quantities					Small Lots		Commercial Finish				
Pitch	4-6		8-12		16 up	4-6		8-12		4-6	8-12	16 up
	Rgh.	Fin.	Rgh.	Fin.	1 Cut	Rgh.	Fin.	Rgh.	Fin.	One Cut		
Annealed tool and tough alloy steels	0.08	0.025	0.08	0.035	0.03	0.04	0.02	0.04	0.03	0.025	0.03	0.03
Soft steels and medium cast iron	0.12	0.05	0.12	0.06	0.05	0.08	0.04	0.08	0.05	0.045	0.05	0.05
						1 Cut		1 Cut				
Soft cast iron	0.15	0.065	0.15	0.075	0.05	0.04		0.05		0.05	0.06	0.06

Table III—Cutting Speeds

	Tool and Alloy Steel	Medium and Soft Steels	Cast Iron
Rgh. cut	70- 80 ft.	100-110 ft.	75- 90 ft.
Fin. cut.	90-110 ft.	130-150 ft.	90-110 ft.

Table IV—Feeds and Speeds—Helical Gears

Use same cutting speeds as for straight spur gears.

Helix Angle	Feed
0-36 deg	Same as for straight spurs
37-48 deg	80% of straight spur feed
49-60 deg	67% of straight spur feed.
61-70 deg	50% of straight spur feed.
70 up	33% of straight spur feed.

Number of Cuts—For quantities of 31 pieces or more, take two cuts in separate settings. Rough with double lead hob, finish with single lead finishing hob.

For small quantities, use single lead finishing hob and finish in one cut, where only ordinary accuracy and finish are required.

For quantities of 30 pieces or less, where accuracy is mandatory, take two cuts in the same setting with single lead hob.

Number of gears per chucking—For extreme accuracy do not chuck more than four gears per setting, and for large gears, not more than three. Gear blanks must be accurately machined to eliminate accumulative errors when chucked in multiple.

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chine specification chart for the No. 5-A hobber (not shown) leads to the specification of a speed of 105 r.p.m. for roughing and 130 r.p.m. for finishing.

To find the cutter approach consult Fig. 6. The tooth depth for 8 pitch is 0.270 in., the diameter of the cutter is 3 in., and the resulting cutter approach as read from the chart is 0.86 in. The total length of cut is therefore 4.86 in.

The time for the roughing cut is next found from Fig. 8 to be 58.0 min. The time for the finish cut is found to be 51.0 min., making the total cutting time for four gears, 109.0 min. The roughing hob cuts the teeth to full depth, leaving stock for the finishing hob only on the faces of the teeth. The length of cut for the finishing operation is therefore taken as 3 in. The handling time is found from Fig. 5 and includes time for closing and locking the tailstock, adjusting to cut and all time incident to the operation as fell as the time for changing the pieces. The curve value is 4.5 min., to which is added 3.2 min. for resetting the machine and changing feed gears for the second cut.

Thus the total time per chucking of four gears is 116.7 min., or 29.2 min. per gear. To this time is added 10 per cent of the cutting time, and to the total 15 per cent is added to compensate for personal allowances and variations, resulting in a standard time per piece of 36.7 in.

In the installations where these data were developed, the operator ran this machine and a No. 13 Brown and Sharpe gear cutter. The premium allowance added to the standard time should therefore be based on running two machines, and was fixed at 40 per cent. The premium allowance is 51.4 min. per gear on this basis. The operator's division of the saving is 20 per cent per machine, or if he keeps both machines producing at standard rate, his day earnings are increasing by 40 per cent.

Ed. Note. In the first installment of this article (*AM*-Vol. 77, page 421) the cutting speed used in the example did not agree with Fig. 2. This was caused by a change in the chart made at the suggestion of the gear shaper manufacturer.

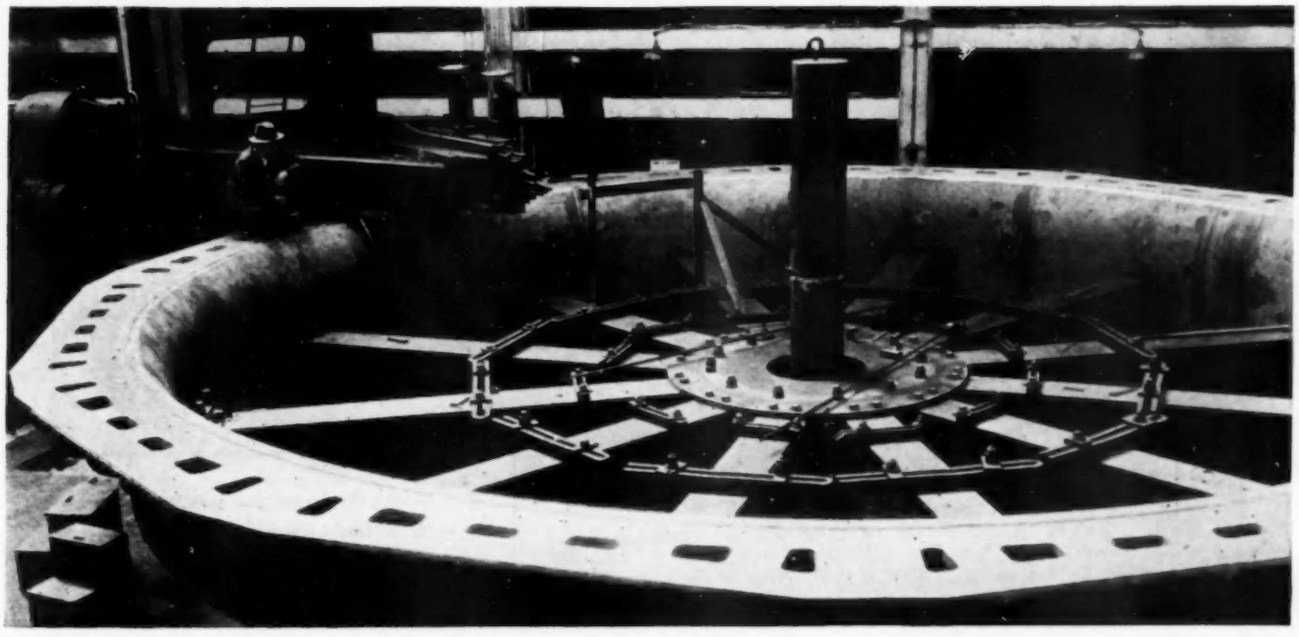
Saving Time in Setting Keyseating Cutters

ROBERT S. ALEXANDER

To eliminate lost time in setting Woodruff keyseating cutters central with work held in the machine vise, especially in the changeover to work of different diameter, I used simple gages made in the following manner:

Several short pieces of shafting of various diameters had generous flats milled on one side. These pieces were held in the machine vise with the flat sides against the movable jaw. Having carefully centered the keyseating cutter of the size to suit the piece now in the vise, a keyseat was sunk in to the correct depth. In changing from one size to another, it is the work of but a few minutes to insert the proper cutter, place the gage in the vise and set the cutter to the keyseat milled therein. After tightening the clamping screw on the cross-feed slide the cutter is ready for cutting keyseats central in any number of pieces of the same diameter.

The purpose of the flats on the gages is so that when the gages are held in the vise with the flats against the movable jaw, the keyseats cut in them will be correctly positioned automatically.



Boulder Dam machinery begins to take form in the shops of the Westinghouse Electric & Manufacturing Company. A throat liner for one of the dam's huge penstocks is shown being faced by the boring mill in the left background. The steel casting weighs 40 tons, measures 36 ft. in diameter and completes one revolution in 2 min.

Multi-Blade Cutting Tools

Their Design and Use—II

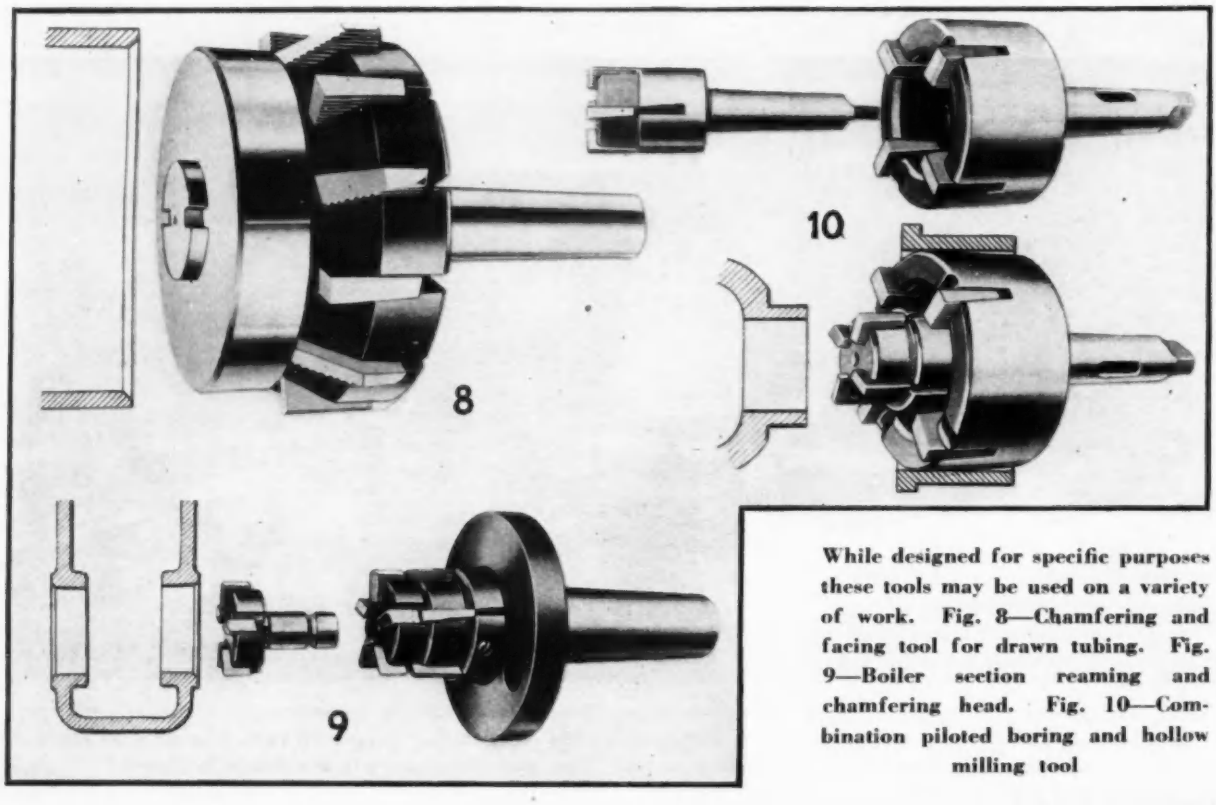
R. R. WEDDELL
The O.K. Tool Company

Following his introductory article in the last number, the author describes some of the more intricate designs used particularly for quantity production outside the automotive field

AS SHOWN by several articles in this paper (*AM*—Vol. 77, pages 6, 74, 109 and 144), the sequence of operations for automotive parts varies considerably in different plants. However, the tooling is generally similar. Tool designers in automotive shops have designed many combination tools which are used successfully and which are well known to automotive production engineers. Other industries use similar parts and could often adopt this type of tooling. For instance, parts for small electric motors, radiator or boiler sections, valves and household utility devices suggest similar production methods.

A simple tool, which can be widely applied, is shown in Fig. 8. Specifically designed to finish the ends of drawn steel tubing, it may be employed for like work on many other parts. A hardened and ground piloting disk is located ahead of a dual set of adustable cutting blades. The pilot guides the tool on the smooth inside diameter of the tube while one set of blades does the chamfering. Feeding further in, the other set of blades cleanly faces the end of the tube. This tool may be used on an ordinary drill press and still give a fine and accurate job.

The machining of radiator and boiler sections requires compact tools capable of standing up under the severe service imposed by this industry's sturdy special equipment. A representative tool is illustrated in Fig. 9. The two opposite holes, shown in the section of the casting, are finished on opposed-spindle machines simultaneously. The hole is first roughed out by a husky boring head. As this tool bears the brunt of wear in breaking down the rough cored hole, it is made separate for quick replacement. The taper reamer and chamfering tool (not shown) follows to finish up the hole. The operation may be performed in as few as seven revolu-



While designed for specific purposes these tools may be used on a variety of work. Fig. 8—Chamfering and facing tool for drawn tubing. Fig. 9—Boiler section reaming and chamfering head. Fig. 10—Combination piloted boring and hollow milling tool

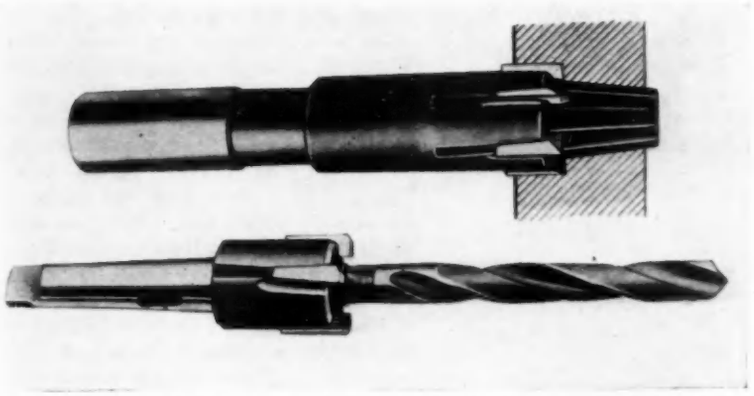


Fig. 11—Solid tools may be used in combination with inserted blade tools in the smaller sizes

11 shows how drills or reamers may be fitted into an inserted blade boring tool. On the tool using the drill, a tapered hole was reamed into the body and a slot cut through the shank to drive the tang of the drill; or the inserted blades may drive the solid tool by fitting into the flutes of the latter. This is only to be recommended for light work as an excessive cut may open the slots of the inserted blades and cause them to loosen.

Where parts of extreme accuracy are required, three operations should be used: first, the roughing, next, the semi-finishing, and finally, the finishing. Where a part has many surfaces to finish, the tools may be too complicated

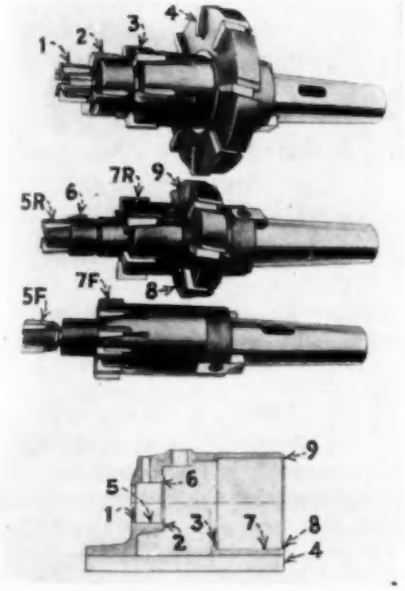


Fig. 12—Three combination tools are employed to finish the numerous surfaces of a portable tool motor housing

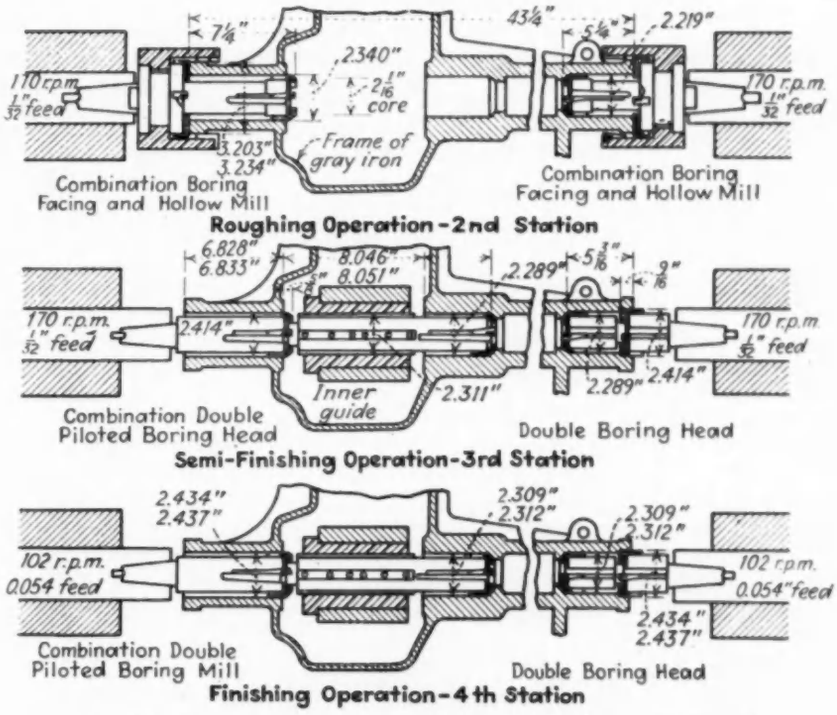


Fig. 13—An opposed-spindle boring machine with three sets of combination tools is used to finish a gear-driven mower

tions. The cutter blades may be of super-cobalt high-speed steel, stellite or tungsten carbide. Similar designs are suggested where facing or tapping is required. On the former an adjustable facing head is incorporated. On the latter, taps with inserted chaser blades, or collapsible taps, follow the roughing tool. All these tools must be short and stubby, easily replaceable or renewable, and designed so that the one on each side does not interfere with that on the other.

Parts requiring short inside and outside turning operations, such as plumbing fixtures and valves, can be made with the ingenious tool pictured in Fig. 10. Here the inside is core-drilled and the outside diameter hollow milled. The tool, shown disassembled in the upper view, consists of a hollow mill with a ground body for piloting if desired. Into it is fitted a boring tool; it, too, has a hardened piloting body. The boring tool cleans up the hole. Then the hollow mill goes to work, being further guided by the piloting surface on the boring head back of the boring cutters, which runs in the hole just bored. Many operations ordinarily turned can be cut more quickly with hollow mills and in conjunction with other operations.

Inserted blade cutters are to be desired for combination tools as the cutting edges are renewable and adjustable. However, on small tools, it is impossible to obtain sufficient strength securely to retain the blades in the body. Then solid combination tools may be used. Sometimes solid tools can be combined with inserted blades to advantage. Fig. 13 shows a set-up along these lines with the tools evolved by a progressive manufacturer of portable electric tools to finish small motor housings. The numbers on the line drawing of the casting are finished by the corresponding numbers on the tools shown. *R* and *F* indicate the surface is roughed or finished. It will be noted that only one operation is indicated on surfaces 1, 2, 3, 4, 6 and 9, meaning that a single operation suffices for the accuracy and finish required. The short time in which the many surfaces and pieces can be machined at a reasonable tool cost can readily be appreciated. Every if just two are used to rough and finish respectively. Additional tools to finish only a few surfaces may be found more advantageous.

Fig. 14—For the operations shown diagrammatically in Fig. 13 these tungsten carbide tools are employed

thing has been built into the tools. Their set-up and sizing time is thus minimized while production times have been combined.

Cemented carbide in combination tools has proved favorable where quantity production warrants its use High production schedules are maintained in the manufacture of the main frame of a high-power gear-driven mower. This demand is met with intricate tungsten carbide tools operating on a special opposed multi-spindle boring machine. This machine completely finishes the many bores of a large casting. Operations on the main shaft centers, shown in Fig. 13, are performed by the tools illustrated in Fig. 14.

First, the outer bearings are rough bored, faced and the outside diameter of the bearing hollow milled for the dust ring, all in one pass. The tool built in combination has the adjustable cutter blades tipped with carbide. The boring and facing head is integral with a hollow mill fitted to this body. The high-duty drive is through a lug in the hollow mill and a key to the boring and facing head. Similar tools, of slightly different overhangs, machine each end simultaneously.

Semi-finishing follows the roughing operation at the third station. Here the inside bore is roughed and semi-finished. The tool is accurately guided by the strip pilot running in a guide bearing between the bores. The opposite end of the casting is semi-finished and counterbored by the double boring head. This tool is supported by the guides of the spindle boring bar, which are close up to the work. Similarily designed and guided tools accurately finish the job to the dimensions and limits shown.

The cutter blades are well backed up in the cutter body. Generous chip clearance is allowed by the use of wide and deep chip grooves. About 1,500 pieces are machined between grinds. The whole comprises an efficient production job which has been effectively and ingeniously solved by the combination of well designed machine tool and cutting tool equipment.

The bouncing balls—New Departure dresses up its familiar attraction for A Century of Progress. A new attention getter is the spectacle of two large balls rolling without apparent propulsion about a track (glass case in center). A hedge had to be put up to keep the crowd back. For the more serious minded New Departure has filled out its eye-appealing exhibit with films on plant processes, a mural depicting fields of use for its products, a mural on the new fad of cycling and models of its famous coaster brake, and cases of the various types of ball bearings that are made.

Grinding Drills for Deep Holes—*Discussion*

JAMES MCINTOSH

In an article under the title given above (*AM*—Vol. 77, page 184), K. Crabill describes a method of grinding drills for drilling deep holes to avoid the unnecessary withdrawal of the drills to clear the holes from chips.

To avoid this loss of time and to increase production, I used a cam feed that elevated the table of the drilling machine while the spindle remained stationary vertically. The profile of the cam was such that the first part of the drilling was done at a relatively faster feed than the final part. This method gave the highest rate of feed up to the time when the drill would tend to clog. Then the feed rate would automatically slow down to relieve the drill and to provide time to permit the chips to clear the drill.

In his article, Mr. Crabill tells us that before grinding his drills in the way he describes, it was necessary to withdraw them at every half-inch after they had reached a depth of three inches, and to clear the chips from the hole. Suppose Mr. Crabill had used a cam feed so designed that the feed would automatically decelerate from maximum to minimum, and that the minimum feed was based upon the ability of the drill to relieve the hole of chips at a depth of seven inches, and would cut out the delay incident to drill withdrawal, then he would have found that considerable time would have been saved.

It is possible to design a cam to feed the drill to any predetermined depth, stop, withdraw the drill and dwell long enough to permit moving the work for drilling the next hole. This time delay on the part of the cam would decide the rate of output.

EDITORIALS

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EDITORS

A Code Dead Line

When you read the article by Donald B. Richberg, beginning on page 457, try to forget that his whole background is that of a man long identified with union labor councils. If the article, which was delivered as an address in New York, had come from one of the more progressive of our industrial leaders, the chances are that it would have met almost universal approval. As it is, many of the points made are exactly in line with opinions expressed by business men during the past year.

The proposal to establish a code dead line, which is implied in Mr. Richberg's statement that action must be taken within sixty days, is fair warning that the NRA (National Recovery Administration, in case you are not up on Washington slang, NIRA is the National Industrial Recovery Act) is in deadly earnest on this matter of speed. The appointment of the President's new Council is an indication that he shares this feeling.

For most industrial executives the Richberg threats are unnecessary and unmerited. Unfortunately, the recalcitrant ten per cent referred to by Mr. Roosevelt are still as much in need of coercion as ever. They are the ones who are taking advantage of low wage rates to build up inventory before a code forces them into line, and thereby providing powerful arguments for the labor organizers. Hence the need for speed in preparing and presenting the kind of code that will cover the immediate situation for each industry.

The real reasons for much of the delay are two: The difficulty industry finds in getting its own ideas sorted out and adjusted; and the inability of the NRA to give categorical answers to questions that are as new to administrators as they are to everyone else. Rapid progress is being made in both of these situations and there is every reason to believe that code hearings will soon reach the mechanical or routine stage.

Wages and Profits

Industry has an opportunity in the new National Industrial Recovery bill to set its own house in order and to wipe out unfair competition, assisted by what is probably one of the most drastic laws ever on our books. Management will do well, however, to realize that the intent of the bill is primarily to afford employment and increase purchasing power rather than to add to the earnings of capital. It reverses the old formula, "There must be profits, or there can be no wages," to read, "There must be wages, or there can be no profits."

We are starting on a new road and there is little likelihood of abandoning the effort to secure better methods, even if the present plan fails to accomplish all that is hoped of it. "We have," to quote Senator Wagner, "a widening concept of business—that all business is affected with a public interest. That is the necessary consequence of the growing complexity of our economic machinery and of the increasing interdependence between one state and all states, between one industry and all industries, between employment anywhere and employment everywhere."

More and more forward-looking business men are accepting this philosophy which leads inevitably to better management and planning in all industries. Management is being encouraged to devise new methods of its own for the strengthening of all business relations. Curbs are being placed on the unscrupulous manufacturer that can, with the aid of industry itself, drive him out of business. We cannot expect perfection without making many mistakes. But we can keep our eye on the goal of greater stability in employment which also spells purchasing power and profits.

The Capital Goods Industries

Some months ago, when the drive of the Industrial Rehabilitation Committee first got under way, Virgil Jordan, then economist of *The Business Week*, presented statistics and calculations to show how important a factor in the depression the prostration of the equipment industries has been. He estimated that some 1,600,000 men in these industries were unemployed and calculated that for each one of them three others in the consumption goods industries were idle.

Yet we hear talk from Washington to the effect that there should be a moratorium in purchases of machinery. Could anything be better calculated to undo the good that should come of the codes being set up for the consumption goods industries? Who will consume these goods if the men of the equipment industries are out of work? They constitute a substantial portion of the market.

Every man in the capital goods industries should miss no opportunity to bring home this important truth to those in Washington who have never been in contact with these industries and who therefore have little conception of their place in the economic picture.

Mouse Traps and Modern Business

Emerson's mouse trap maker whose customers wore a trail to his door has too many followers. Even in these days when orders are none too plentiful a sur-

prising number of concerns wait for business to knock at their door.

Some, however, do not take Emerson too literally. Even though they are convinced that they build the best mouse trap, they go after every possible customer lest some builder of inferior traps get the order.

This is no fanciful imagining. We have recently seen several letters regarding a live inquiry that were most Emersonian. They said they needed the order and hoped the customer would write in the near future. The chances are that some of those who received the inquiry will not wait to be hunted up by the customer. They will go after him—and get him.

CHIPS

President appoints Sec. Ickes as public works administrator . . . Announces permanent appointment of Hugh S. Johnson as NIRA administrator . . . Signs cotton textile code with certain modifications of his own and urges speed on part of other industries . . . Approves extension of Cotton Code to silk and rayon . . . Considers plan for voluntary general code ad interim . . .Threatens to set code dead line if necessary to spur laggards . . . Names executive council made up of Cabinet and heads of various recovery agencies . . . Frank C. Walker, Democratic treasurer, will be executive secretary . . . Many industries complete draft codes . . . Several are presented . . . Sec. Wallace will push acreage reduction policy regardless of present shortages in major crops . . . Reports cotton acreage cut plan a success . . . Sec. Swanson recommends allotment of $77,000,000 from public works fund for modernization of five battleships . . . Roosevelt orders continuation of 15 per cent federal pay cut at least until Jan. 1 . . . Orders postmasters to be chosen on civil service tests . . . Coordinator Eastman starts machinery to improve railroad freight handling . . . President approves first public works projects.

German railways announce construction program to employ 300,000, include subway project to connect Berlin terminals . . . Treasury issues first financial statement under new double-budget plan which separates regular and emergency items . . . Hitler tells the extremists in his party to keep hands off industry, points out need for finding work for 5,000,000 . . . Mussolini warns fascists against black silk hats, black cotton shirts always proper . . . Bolivia and Paraguay resume fighting . . . Brazil lends Zeppelin company money to build dirigible hangar 16 miles from Rio . . . Regular service to Germany, 20 trips a year will be started when hangar is complete . . . First South American steel mill starts operating in Chile . . . China orders 36 pursuit planes from Curtiss.

Deposits in New York banks rose rapidly in second quarter . . . P.R.R. repays $9,500,000 of R.F.C. loan . . . Comptroller of the Currency's call for national bank statements, first this year, taken as indication of return to normal in banking operation . . . Nash resumes dividend payment by ordering 25 cents paid on August 1 . . . New bank law helping to expand bank credit through reduction of reserves brought about by transfer of demand to time deposits . . . Dollar drops to 50-year low, below 70 cents, as British turn to support of Roosevelt ideas . . . Sterling reaches old parity with dollar . . . Silver accord reached at London Conference . . . Banks get until August 14 to report on affiliates . . . U.S. delegates at London kill plan for free gold market.

Boeing plant's 2,200 employees will be busy for 6 months filling orders for transports and army planes . . . Tennessee Coal & Iron adds 500 men as 5 open hearths are fired, recalls 1,500 as rail mill increases operations . . . Sharon Steel Hoop and Youngstown Pressed Steel restore latest cut . . . Selection of five Southeastern railroad leaders completes Eastman's board for effecting economies in railroad operation . . . Baldwin June orders best since November, 1931 . . . Erie car shops at Dunmore go from 8 to 18 days a month basis . . . National Cash Register raises wages and salaries 10 per cent . . . Reading recalls 400 for locomotive and car repair on 5-day, 8-hour basis . . . General Motors sales in June double those of previous June, best since June, 1931 . . . American Car & Foundry reopens wheel plant at Berwick after 6 months idleness . . . Truscon Philadelphia branch raises wages 10 to 25 per cent . . . Master Electric announces 5 per cent wage boost . . . Farrel-Birmingham Co. raises wages 10 per cent, adopts 40-hour week . . . DuPont raises wages 10 per cent, as does Remington Arms, also Kelvinator and RCA Victor.

Automotive exports in May best since those of May, 1932 . . . Brazil buys 38,000 tons of rails and accessories from U.S. Steel . . . General Motors exports in June more than double those of June, 1932 . . . American Russian Chamber of Commerce reverses stand and favors Soviet recognition . . . Great Britain lowers trade deficit to a little over twenty million pounds in June . . . Japan's exports rose over 50 per cent in last 6 months . . . Roosevelt halts shipments of "hot oil" in interstate commerce.

U. S. Steel backlog gained 176,000 tons in June, new high for year despite higher operating ratio . . . Electric energy output reaches 14.7 per cent increase over 1932 . . . All deliveries of wheat now over $1 . . . Cotton up on report of success of acreage reduction campaign . . . "Iron Age" composite scrap and pig iron prices rise . . . Copper reaches 9 cents, lead 4½ . . . Business Week index at 66.6.

NRA Speeds Codes to Forestall Recession

Washington, D. C.—Approval of the Cotton Textile Code by President Roosevelt and General Johnson cleared the air of many doubts and misunderstandings on the part of industry. Within the week after the signing of this code the steel, lumber, cement, electrical manufacturing and other important groups presented their drafts and much progress was made by the rest. In spite of this gratifying response the NRA is still concerned about the way prices are outstripping purchasing power. Hence the voluntary, t e m p o r a r y "blanket" code to tide over the emergency until the respective industry codes can be introduced and settled.

Outstanding features of the Cotton Textile Code are:

(1) A marked increase in the minimum wage to be paid by the industry —$13 for the North and $12 for the South for a uniform work week of 40 hours, as contrasted with recently prevailing minimum wages as low as $6 to $8 for an average working week of 50 hours or more;

(2) The limitation of hours of labor and shifts in order to effect not only re-employment of the unemployed in the industry since the depression, but also the absorption at the present rate of activity of considerable numbers from the outside;

(3) The abolition of child labor;

(4) The inauguration of a continued planning and fair practice agency to supervise execution of the code and the continued solution, as they arise, of problems of the industry through devices ranging from an open trading association to coordination of credit and control of machinery.

In addition to the limitation upon hours of labor, the new code limits the hours of productive machinery to two shifts of 40 hours each, and, in a condition added by President Roosevelt, calls a truce on the so-called "stretch-out" system pending a forthcoming report to Administrator Hugh S. Johnson by an investigating committee composed of Robert Bruere, chairman, B. E. Geer and Major George Berry.

It is estimated that employment in the textile industry should, under the code, return to the level of employment before the depression and should, assuming the continuation of present trends, afford an opportunity for employment of an additional 15 to 20 per cent.

Finally, the code sets up a continuing planning and fair practice agency—whose decisions will be subject to review by the National Recovery Administration and to which the Administration will name representatives of industry, labor and its own organization—to supervise development of statistical, accounting, credit and other controls for unfair and destructive price and trade practices as well as to carry out the long range planning in the interest of the industry and the stabilization of employment.

The major part of the silk industry and the rayon industry have been granted permission by the President to adopt the cotton code pending perfection of its own, and other textile groups are expected to follow suit.

The Labor Side

Talk to any manufacturer in any industry and you will soon learn that he fears that NRA has sold him out to labor unionism, that the NIRA marks the end of the open shop. If he is right one should find nothing but rejoicing in the camp of labor. On the contrary, here are a few of the things labor is worrying about:

(1) The act itself separates labor from employers; labor thinks it should be represented in and as a part of "industry," not set aside and opposite to industry; it perpetuates the old battle. Labor was not consulted in drawing up the Cotton Textile Code. The labor adviser, on that code, Thomas McMahan, did not spill his beans until the open hearings and was soundly reprimanded by Presiding Deputy Administrator W. L. Allen because he had not brought them up in the conference. He emphasized the fact that labor does not sit in, that the codes are formed by the employers and thereafter are subject to suggestions (by labor and others) and revisions only after hearings, not during formation.

(2) Labor feels it is really not fully represented in the NRA organization. There is Donald R. Richberg, labor attorney, who is general counsel of the NRA, and Edward F. McGrady, also a labor attorney, who is assistant for labor to Administrator General Hugh S. Johnson. There is Heber Blankenhorn, laborite journalist from New York who is in the public relations section, and that is all that labor has in the 130 important places in the NRA. Dr. Leo Wolman, chairman of the Labor Advisory Board, is not actively "inside."

(3) Labor wants more recognition, not necessarily of organized labor, but of liberal thought and advanced industrial relations, among the deputies who are the keystones of the various industrial arches upon which the towering structure of NRA is being erected.

• INDUSTRIAL REVIEW •

Some machinery builders and distributors have booked enough business lately to bring them into black figures, others are encouraged to expect similar success shortly. Formation of the Machinery and Allied Products Institute is looked upon as a constructive move and one that will straighten out some of the worst problems of the machinery industry.

Distributors in the New York, Philadelphia and New England territories are finding things rather quieter in July than they were in June. Inquiries are more substantial but orders have subsided. In Pittsburgh, on the other hand, orders are coming in, particularly in the supply end which is going strong. Here, too, inquiries are much stronger. Supply business in Cincinnati for July promises to exceed that of June which was the best in many months. Machine tool orders have not been numerous but some builders have been fortunate. Inquiries for good used machines continue strong.

In Cleveland there is a feeling that August business will turn out fairly well as compared with the past two summers. Some machinery men are fearful of a slump in the fall but the opinion is not general. Detroit business has suffered from uncertainty about the Michigan 3 per cent sales tax. Business in supplies continues good and orders for equipment seem imminent.

Wages have been raised in St. Louis and employment is much larger. Supply business is lagging somewhat and there is some worry among executives over the effects of the NIRA. Chicago reports some machine tool orders actually placed and a steady growth in the supply end. Orders for attachments and repair parts are heavy. On the whole the feeling is much better. The same may be said of Milwaukee, where employment and payrolls are increasing steadily.

(4) Labor feels that NRA is leaning too far toward the company union in its interpretations of the "collective bargaining" provisions of the law.

(5) Organized labor, and unorganized labor so far as it could be represented on Secretary Perkins's Labor Advisory Board to NRA, was the leader in the demand that something be done to push industry to the filing of its codes. It holds that every week and every day of delay makes it possible for unethical manufacturers to push their cheap labor to greater efforts under sweatshop methods, and threaten the slump of accumulated cheap goods which they hold will wreck the whole recovery plan. Their contentions there were supported by the consumers' group.

(6) Labor's receptivity to the idea of a truce on organization activities during the period of code preparation by industry is yet to be demonstrated. The plan as at first proposed cut across such activities as those of President Lewis of the United Mine Workers of America, and is regarded by many of the labor leaders not only as a curtailment of their own legitimate efforts but as a backward step from a social viewpoint.

The 30-Hour Week

(7) Organized labor will not weaken on the idea of a 30-hour week. The President's conditions imposed when he approved the Cotton Textile Code on Sunday, July 9, stated, however, that protection should be given to higher wage groups, and wage scales should be agreed on later for the cleaners and outside workers of the mills. The 40-hour week in the textile mills has been tentatively accepted by labor, but with ample reservations. The fight for the 30-hour week will be carried on throughout the life of the NRA.

(8) Union labor approves, in principle, the provisions of the NIRA itself against setting minimum wages by classes of workers that may tend to become maximum through their very precision of statement, but it believes that purchasing power is not going to be built up by paying low type labor $12 a week and letting highly skilled workers get jobs at any price they can. The fight for the highly paid worker will not stop.

(9) Union labor looks to the development of the industrial union as a supplement to/or in some cases a substitute for the craft union, as a result of the NIRA. Engineers, firemen, machinists, electrical workers, etc., who work in the unionized coal fields all belong to the United Mine Workers of America, and this tendency will be pushed in the formation of new or the realignment of old unions in the new "partnership." This tendency of labor thought has much significance for many industries. It is a drive directly at the company union.

(10) The big show-down of the place and power of organized labor under NIRA will come when the steel code comes up for hearing. This is frankly anticipated, practically promised.

The NRA Attitude

Since the whole NIRA situation looks perfectly simple to General Johnson, he finds it hard to see why there is so much uncertainty and suspicion on the part of both labor and industry. He has expressed himself rather vividly on more than one occasion but he summarized the attitude of his organization once more for a group of business paper editors and publishers last Friday. The following paragraphs are taken from his observations:

"In the short time since the National Industrial Recovery Act was passed, four of the greatest industries in the country have been able to get together to frame a constitution for self-government in their industries. Whatever people may say about that law—and I, myself, think of it as an experiment, there is no question about that—it does permit something that a great many people have been seeking since the war. No small part of our recessions and peaks in business have been due to the fact that business has had no power to govern itself. The Sherman anti-trust law was wholly prohibitory; the Federal Trade Commission was purely a police organization. Former Chief Justice Hughes said that after 40 years of judicial interpretation of that act it was safe to say that no business man was informed as to what he could do under that act, although he was told many times what he could not do under the act.

"A little group of men who had sat in the mobilization of business during the war—an organization that left its mark on our whole industry in a way that I think has been largely overlooked—proposed this same sort of a set up for the present emergency. They contemplated some kind of an understanding between government and industry under which, if industry has a plan to present in a collective fashion that is helpful not harmful to the public, it can come and present it and get a license to go ahead under the supervision of some governing body—not a police body but only one to see that nothing is done against the public interest.

"The larger industries want to attempt that experiment and while nobody ought to sit down and tell them in advance what they ought to put in their code, what they should leave out and how it ought to be administered, after a code has been agreed upon and after we have taken out everything that might be termed an abuse, we ought to allow these industries the widest extent we can to govern themselves for the benefit of themselves and the country. That is the theory of the operation of this law. That general purpose has been somewhat obscured in the public mind by the absolute necessity with which we are faced in this country for an employment drive. The raising of prices and the volume of production have already unquestionably far outdistanced consuming power. The things produced have exceeded the capacity of the country to consume them in a country with twelve million people out of work.

"The first phase of the operation of this law is to spread employment and try to create a consuming power for the greatest market in the world, which we undoubtedly have. The first thing to do—never losing sight of the main purpose of this act—is to put these people back to work. If you don't do that you are going to have a crash. You will be like a man who exposed himself to smallpox and lost sight of the vaccination that was right in front of him. To see if we can start this upward spiral is the reason why we place so much emphasis at this early stage of the game on hours and wages.

"I don't know how to make it clearer. I find that in dealing with the people who claim to be bewildered that they have not read the only two bulletins that have come out from here: Number 1, the President's Statement outlining the policies of the Act; and No. 2, telling how codes should be submitted. Most everything else that has come out has been newspaper conjecture and mostly wrong. Just remember that we don't mean more than we say and that we *do* mean what we say.

The Capital Goods Industries

"Capital goods industries will benefit in a degree from the public works program with which I have nothing to do. Undoubtedly all industries go up together and go down together. There has been a great deal of neglect and obsolescence in this country which will have to be rebuilt. Of course the capital goods industries will receive the benefit. They are always slower than others. I don't know how we can speed them up. We cannot change the fundamental economic principles.

"I think that the necessary installation of new equipment should go forward. If you stopped inventiveness and progress that would be very stupid. I do think that for a short period it would

be wise not to emphasize the installation of machinery that would tend to further reduce the field of employment. It is not our purpose here to stop economic progress.

"As far as this organization is concerned I have said over and over again that it would not be used as an instrumentality for the unionization of any industry. The law provides that all codes shall provide that employees shall have a right to bargain collectively through representatives of their own choosing. I have lived in a town that was supposed to be an open shop town. We had unionized shops at one end of the town and company unions at the other end. It was a fact that a man coming in with a union card did not receive a rebuff at the employment office but was fired within a few days. That is out as far as these codes are concerned. I am going to execute this law just the way it is written. The way the law is written is that labor shall have the right to bargain collectively, that employers must receive their employees if they come to bargain collectively, to agree not to require as a condition of employment that a man join a particular union or to refrain from joining a particular union. I have been a manufacturer and I want to say that it is repugnant to me that any man employing another man should impose such a condition. But I want to go further and say that this act is not for the purpose of unionizing labor.

They Jumped the Gun

"Both sides jumped the gun. Even before this act was passed it was said that the President of the United States wanted everybody in a certain industry to join such and such a union. Then, too, I have seen things that went out saying that you could get the benefits of this act only if you joined a company union. The purpose of the act is not to unionize labor nor does labor have to join a company union. This was emphatically brought out in the cotton textile code—the benefits given to labor were given because the government and the industry wanted to give them to labor. For one thing, child labor for 25 years has been a blot on this country, but we could not get rid of it because the employers could not act together. If a man wanted to raise the conditions of his own employees he had to look around and see what other employers were doing with their employees otherwise the chiselers would be able to force him out of business.

"The President is the final authority and I want to say that he is giving particular attention to our organization and has been posted on our activities and he does pass on every question. He keeps himself daily in touch with what is going on.

"I believe that people should not sell at less than cost of production. We should have what is known as an open-price agreement—that they report their sales and the prices at which they sold.

"I am not going to set up any police department, because the first person who breaks that agreement will be reported and we will ask, "What about it?" If this thing works as it is supposed to work, public opinion will do to a violator all the policing that is necessary."

Noted Speakers to Address International Automotive Congress

Sponsored by the S.A.E., the program of the International Automotive Engineering Congress to be held at the Palmer House, Chicago, August 28 to September 4, is replete with famous names. Georges Broulliet, of Paris, France, a member of the French Society des Ingenieurs de l'Automobile, is prominent among the foreign visitors. He will discuss independent springing.

C. F. Kettering, of General Motors, will tell of the "Engineer's Place in the Economic Picture." Lawrence H. Pomeroy, of the Daimler Co., Coventry, England, will discuss "What is the Matter with American Cars?" "The Future of Individual Transportation" will be the subject of a talk by W. D. Stout, of Stout Engineering Laboratories.

At the production session, "Current Practice in Finishing Gear Teeth" will be described by F. W. Cedarleaf, of Buick, while Joseph Geschelin, *Automotive Industries*, will deliver a paper on "Equipment Policies and Utilization of Machine Tools."

Among the many other addresses listed for the Congress are:

"Engine Mountings," Alex Taub, Chevrolet Motor Co.

"Budgeting Body Construction and Tool Costs," N. H. Manning, Briggs Manufacturing Co.

"Air Conditioning and Relative Refinements for Automobile Body Design," F. A. Moss, George Washington University.

Motor trucks and motor coaches, transportation and maintenance, fuels and lubricants, and aircraft and aircraft engines will be covered during the various sessions. Seven S.A.E. past presidents will participate in the meetings.

Machine Tool Orders Increase 42 Per Cent

May's sharp gain in machine tool orders was continued in June by a 42 per cent increase in the National Machine Tool Builders' index of from 27.6 to 38.3. This figure is nearly three times the low point reached in March and represents a counter-seasonal increase for three successive months. Orders are now above the 1932 average of 35.5 with June the best month since May, 1932.

At a special meeting in Cleveland on July 13 members of the Association voted to approve the recommendation of the board of directors that they join the Machinery and Allied Products Institute. J. D. Benedict, Landis Machine Co., was elected to represent the N.M.T.B.A. on the institute board.

Blackall Heads Taft-Peirce

Frederick S. Blackall, Jr. was elected president and treasurer of The Taft-Peirce Manufacturing Co., Woonsocket, R. I., manufacturers of precision tools and special machinery, at a meeting of the board of directors held on July 8th. Mr. Blackall, who will continue as general manager, succeeds the late Gordon Gordon, who died suddenly on June 28. Other officers newly elected are John W. Wheeler, Jr., Bridgeport, Conn., vice president, and William A. Gordon, III, Pittsburgh, secretary.

Mr. Blackall has been associated with Taft-Peirce since 1922, holding successively positions as foreman and metallurgist, branch office sales manager, assistant to the vice president, assistant manager, secretary, and vice president and

general manager, having been appointed to the latter office in 1928.

A member of the American Society for Steel Treating and the American Society of Mechanical Engineers, Mr. Blackall has been especially active in national standardization work. He is a past-president of the Gage Manufacturers Association, chairman of the Technical Subcommittee and the Editorial Committee and a member of the Standing Committee of the American Gage Design Committee, chairman of Technical Committee No. 3 on Machine Tapers, member of the Committee on Standardization of Small Tools and Machine Tool Elements, secretary of Technical Committee No. 17 on Nomenclature, and a member of the Committee on Allowances and Tolerances for Cylindrical Fits.

• BUSINESS ITEMS •

Establishment of the Indiana Gear Works, 1458 E. 19th St., Indianapolis, Ind., has been announced by LOUIS G. BUEHLER, who is general manager. He was previously connected with the Indianapolis Tool & Mfg. Co., for 32 years in various capacities. The new company will serve aircraft engine builders and other users of high-grade gears, cams and intricate machine parts.

The Bodine Corp. has taken over the Anderson Die Machine Co., Bridgeport, Conn., and will manufacture special automatic machinery. The new corporation was formed by ALFRED V. BODINE, formerly assistant to the president, Raybestos-Manhattan, Inc. Others interested in the concern are JOHN C. THOMPSON, JOHNSON STODDARD and NORMAN K. PARCELLS. Capitalization is $50,000.

Poole Foundry & Machine Co., Baltimore, Md., has appointed the McVoy-Hausman Co., Brown-Marx Bldg., Birmingham, as representative in the State of Alabama. James L. McVoy, former representative, and the Hausman-Hardwick Machine Tool Co. formed the McVoy-Hausman Co., effective July 1.

The Chain Belt Co., Milwaukee, Wis., has appointed EDGAR STILLEY as factory representative in the states of Maryland, North Carolina and Virginia. His headquarters are at 210 Snow Bldg. (31 S. Calvert St.), Baltimore, Md.

Since July 1, the Buffalo, Rochester, and Syracuse offices of Crane-Schiefer-Owens, Inc., have operated independently as follows: R. L. Crane Machinery Co., Buffalo; F. W. Schiefer Machinery Co., Rochester, and J. F. Owens Machinery Co., Syracuse. The personnel and organization will continue the same with the three offices cooperating closely. There will be no change in agency arrangements.

The Toledo Scale Co. has established a service department for all of the types of scales it manufactures at its Toledo, Ohio, plant.

• PERSONALS •

COL. FREDERICK H. PAYNE has been elected chairman of the board of directors of the Greenfield (Mass.) Tap & Die Corp., following the resignation of G. S. ARMSTRONG, CLARENCE DAUPHINOT, W. F. MERRILL, HOWARD REID, H. F. TALBOT and JARVIS WILLIAMS, JR., from the board, resulting from the acquisition of their stock holdings by the new

chairman. D. G. MILLARD, New York, W. B. DUMONT, FRANKLIN JUDGE, E. R. KOONZ and F. A. YEAW, all of Greenfield, were elected to the board to fill the above vacancies. CHARLES N. STODDARD continues as president of the company.

FREDERICK B. RENTSCHLER, president of the United Aircraft & Transport Corp., which controls the Pratt & Whitney Aircraft Co., the Chance Vought Co., and the Hamilton Propeller Co., all of East Hartford, Conn., has resigned and becomes vice-chairman of the board of directors. PHILIP G. JOHNSON, vice-president of United Aircraft and president of the United Air Lines, another subsidiary, succeeds Mr. Rentschler, as president.

COL. ARTHUR F. HATCH, vice-president of the Stanley Works, New Britain, Conn., and general manager of the company's branch factory at Hamilton, Ont., has retired, and has been succeeded by JOHN C. CAIRNS.

• OBITUARIES •

HERBERT L. FLATHER, 58, president and treasurer of the Flather Co., Nashua, N. H., manufacturer of lathes, died July 7 after a brief illness. Mr. Flather was also treasurer of the Hurlburt Rogers Machinery Co. He had been prominent in the National Machine Tool Builders Association.

WILLIAM LUKENS WARD, 76, president of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., died July 16 in New York City. Mr. Ward learned the business from his father who set him up on his own account. His knowledge of the work, inventive ability and business leadership were responsible for acquiring control of the above company and expanding its operations until it became the largest of its kind.

WILLIAM A. CALISON, 55, superintendent of motive power for the Monon Railroad and an authority on rail equipment and shop design, died suddenly.

WILLIAM STUEBING, vice-president of the Stuebing Automatic Machine Co., Cincinnati, Ohio, died June 27.

• MEETINGS •

SILVER BAY INDUSTRIAL CONFERENCE. Sixteenth annual conference on industrial relations. August 23-26. Silver Bay on Lake George, N. Y. E. C. WORMAN, secretary, 347 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. International automotive engineering congress. August 28-September 4. Palmer House, Chicago. JOHN A. C. WARNER, general manager and secretary, 29 West 39th St., New York, N. Y.

Doing Without

"Al, how do you take care of inspection at your plant? Does one inspector do both detail and final inspection, or do you have two?"

"We don't have any. The final inspection is up to the assembler or myself if I wish to inspect. I don't believe in an inspection department."

"Why not? Everybody else has one, and everyone can't be wrong."

"Maybe everyone can't be wrong, but I think it can be demonstrated that the majority is always wrong. That, of course, does not make me right. Maybe the answer to the inspection department lies between my idea of none, and other people's ideas. However, my idea is the cheapest, and with my small force I can afford to do without an inspection department and watch results."

"Sure, that's why you can carry out some of your ideas that are not based on common sense. You are nearly a one-man firm and can oversee everything."

"No, that is not the real reason, Ed; sometimes it is harder to do things in a small concern than in a large one. On the other hand we can manage efficiently, only as far as we can visualize the processes of management and reason in terms of fundamentals. If I start without an inspection department, the chances are I can do without one when we get bigger. If I start with one, dispensing with it would be revolutionary and would probably get us in trouble."

"I don't go along with you, Al. When you get bigger, if your ideas don't wreck the firm, you will have to install an inspection department, too."

"Why will I?"

"Because there are more details in a big plant."

"How can there be? If we built a thousand compressors a week, we'd need a much larger plant, but it would be just as easy to account for 1,000 parts as to account for ten. The difficulties of large concerns are largely mental."

"That sounds all right, but it isn't logical."

"It's not psychologically true, but it's actually true. Size or quantity exerts a tremendous influence on people. Maybe it will on me, but right now I claim that I will not need an inspection department even when we get big. The shopman's idea on that subject is changing, too; he resents the implication that outside supervision is necessary to insure quality. He resents having a non-mechanical man set the standard of quality for mechanical apparatus."

"That sounds all right, Al, but you know our inspectors used to find quite a lot of bad parts."

"Sure they did. With an inspector in the department you and I were not interested in quality, except when the number of rejected parts became so great that Williams called us on the carpet. Williams' attitude toward rejections, not pride in workmanship, was the controlling factor when we had inspectors."

"Well, how are you going to cure it?"

"Several ways. First by self-inspecting fixtures, second, by laying out the operations so that each one corrects a possible error in a preceding one. Third, by lessening the probability of rejection as labor value is added to the part. Finally, I will hold the foreman responsible."

"I've heard that expression, 'hold the foreman responsible,' until I'm sick of it. I've been held responsible a hundred times, and it has never meant a thing."

"Agreed, Ed. I don't mean it the way it is usually put up to the foreman. I mean that the foreman will be the judge as to whether the operations on finished parts need inspection, and he can assign any of his men to inspect parts as a regular routine."

"You're an incurable optimist, Al, aren't you?"

Is an inspection department necessary? Does a good foreman and proper fixture design obviate the necessity for one?

Discussion

Thirty-Hour Week

Al is much too concerned with his own immediate future to realize the full value of the short working week. It does appear as though things are going to become a bit more difficult, but that will be true only in the beginning. The entire plan, working on a nation-wide circuit, is bound to be successful in the long run.

To begin with, even a layman in economics, such as Al, will admit that there is little logic in one man working seventy-two or eighty hours a week while another doesn't work at all. Therefore, the thirty-hour week will serve to double, at a conservative estimate, the number of men at work.

Once these men are at work, the industrial future is assured of brightened prospects. It is a cycle, which once begun cannot be stopped. When more is sold and it is necessary to manufacture more, more apparatus is bought. When manpower gets to be in demand wages go up. Once wages go up, we reach what is commonly known as industrial pros-

perity, and we have reached our goal.

Al's own arguments defeat themselves upon examination. He protests that he will need more men. We know that more men at work is the beginning.

—WILL HERMAN, *Superintendent, Tanenbaum Oil Company.*

A good many years ago, when it was quite common for a man to work 16 and 18 hours during each of the seven days in the week, it was an amazingly difficult task to start the legislation necessary for the reduction of the working hours to a mere 14 and 12.

Research shows that the arguments advanced by the opponents of the scheme were almost identical to those used by individuals in opposition at the present time.

We might see what the thirty-hour week will do in Al's plant. First of all, he will have to train at least one man to take over a part of his job. Then he will have to add a third more men to his working force. This will necessitate the purchase of new machines.

Now what will be the effects? The men who have been added to the payroll are taken from the ranks of the unemployed. This means that at last they have the money they need to buy necessities. The machinery purchased by Al's money will start more men working in the factories where the machinery is manufactured. The money spent by Al's increased force will go toward bettering the working condition of many factories.

One single, isolated action of this type would be highly ineffective; thousands cannot help but give industry a sufficiently good push to overcome the inertia of four years' idleness.

—FRED BENNETT, *Superintendent, Standard Products Company.*

A Better Shop

Here is what actually happened to one owner of a small optical shop, employing about ten men, who tried to do something that would give his men a genuine interest in their work and in the firm.

This shop had built up a reputation for the uniform high quality of its product. The reason behind this record was that, every evening after work hours, the owner personally checked all tools, tested each unfinished piece and inspected all completed lenses. With the growth of the business, a complete check-up every night became impossible.

Therefore the owner said to himself, "I have men who can do the work as well as I; they are interested in their work and seem eager for more responsibility. I think I will put them on their own." So the owner frankly told his men that from then on, they alone would be responsible for the correctness of the work.

What happened The next order for over 300 lenses was returned. Scarcely a piece was to size. The entire lot had to be reworked.

While much can be said about this experiment to further the workers' interest, it suggests the exercise of discretion and a fine sense of values on Al's part if he contemplates a similar move in his own shop.—S. D. BRYDEN.

A Better Shop

The most important concern of the employee is the health of himself and family. In many enterprises this is taken care of by a hospital association handled either as part of plant activities or as an outside agency of recognized standing. As part of this plan, it is also considered essential to have a plant emergency hospital to care for injuries of a minor nature.

Another convenience is the provision of steel lockers for each workman.

Actual observation has indicated this idea alone has raised the standard of personal appearance and generally promotes a sense of pride as regards shop orderliness. A feature generally associated with the locker rooms is the provision for proper washing up facilities. Allied with wash and locker rooms, many firms have made provisions for a suitable rest room with appliances for simple cooking together with tables and chairs and in fact a general atmosphere that promotes a restful lunch hour. For those who do not care to bring their lunches, accommodations in the form of cafeterias have been installed where meals are sold at cost.

To encourage their employees along educational lines, some of the more progressive concerns provide evening classes in many essentials, as mechanical drawing, shop arithmetic and even a complete course in some of the higher branches of learning. By proper encouragement on the part of the employer, some successful social clubs have been formed whose activities include monthly card parties, dances and picnics.

Aside from all of these methods of promoting good will, there is a growing tendency on the part of employers everywhere, to institute plans whereby employees may have the protection of group insurance and a week's vacation with pay during the summer months.

—HAROLD L. WYNN,
Executive Engineer,
Pacific Electric
Manufacturing Corporation.

High Finance

Can Ed afford to lose? The question of possible loss is involved in every investment regardless of size. The exercise of careful judgment is required after the possibilities and risks have been fully visualized. Ed must rely strictly on himself and not on the promises of anyone else.

After thinking over the matter, Al will realize that he is in no position to promise to buy back any or all of the stock which he may be able to sell. If he were in such a good financial position, he would be unwilling to sell any stock in his proposed company to outsiders. He would do his own financing and keep all of the profits for himself.

No investment should be made principally upon the basis of freindship or promises. The matter should be analyzed from a basis of what the company has done, is doing and probably will do. Ed should carefully weigh the possible dividends to be made against the very possible chance of losing his thousand dollars or a part of it. However, financial success in a big way is gained by assuming good risks and silently standing the losses. —L. O. BROWN.

One Channel

Al's scheme of buying everything through one channel or agency may save him a little bookkeeping, but he will lose a good many advantages and dollars.

No one salesman is expert in all lines and makes of machinery, and is by no means qualified to choose all of the machines you might require. He is not as well acquainted with your product, or shop conditions, as your own subordinates. He is paid by the firm that employs him and is obliged to put its products to the front. Therefore, he will recommend and sell its machines that are best adapted for your work.

In choosing the equipment, with which Al expects to compete with a world of competitors to make his future profits, time spent will save him many a regret. His bookkeeping expense may be considered nil, if he can secure the most efficient machines on the market for his product. —H. A. GILLILAND,
Mechanical Engineer,
Hamilton, Ontario, Canada.

American Machinist
REFERENCE BOOK SHEET

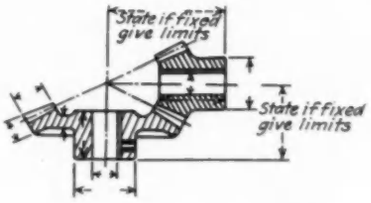
Recommended Practice for Gear Purchasers

AT THE annual meeting, May 4-6, 1933, the American Gear Manufacturers Association adopted the accompanying code of recommended practice for use by gear purchasers. Sample specification sheets were approved for bevel, helical, herringbone, spiral, spur and worm gears. The purpose of the code is to prevent misunderstandings between the gear user and the gear manufacturer and thus to lower the cost to the user. All dimensions that are required by the gear manufacturer and many if not all required by the gear user are shown on these sample sheets. Only important dimensions should be marked with the allowable limit of error, and other dimensions should be marked approximate only, allowing the gear manufacturer to quote his standard dimensions and use his standard tools, thus saving expense to the customer.

Indicate all necessary specifications. Limits of accuracy should be specified, otherwise commercial limits will be used. If any dimension is omitted it will be understood that any reasonable dimension may be used.

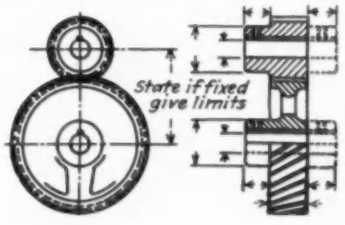
BEVEL GEAR INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth		
Circular pitch		
Diametral pitch		
Pitch diameter		
Angle, pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of screw with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M., state if driver or driven		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



HELICAL GEARING INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth		
Diametral pitch		
Normal diametral pitch		
Pitch diameter		
Teeth, right or left hand		
Angle, helix		
Angle, normal pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of setscrew with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M., state if driver or driven		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



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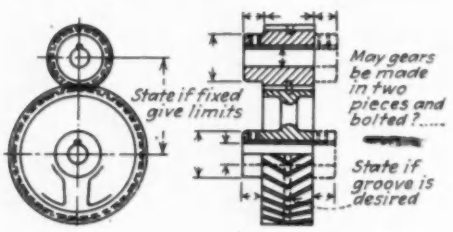
American Machinist
REFERENCE BOOK SHEET

Recommended Practice for Gear Purchasers

Indicate all necessary specifications. Limits of accuracy should be specified, otherwise commercial limits will be used. If any dimension is omitted it will be understood that any reasonable dimension may be used.

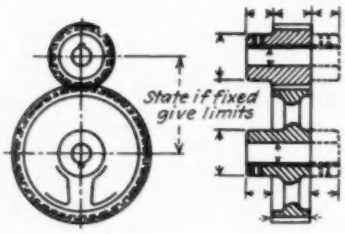
HERRINGBONE GEARING INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth		
Diametral pitch		
Normal diametral pitch		
Pitch diameter		
Teeth, right or left hand		
Angle, helix		
Angle, normal pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of setscrew with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M., state if driver or driven		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



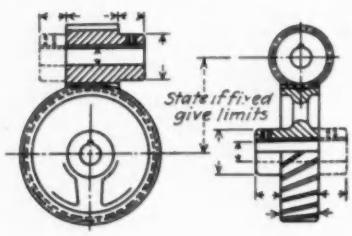
SPUR GEARING INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth		
Circular pitch		
Diametral pitch		
Pitch diameter		
Angle, pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of screw with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M. state if driver or driven		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



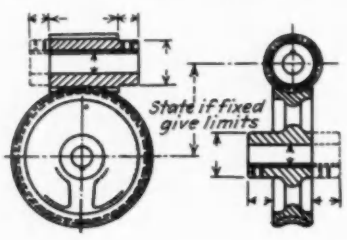
SPIRAL GEARING INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth		
Diametral pitch		
Normal diametral pitch		
Pitch diameter		
Teeth, right or left hand		
Angle, helix		
Angle, normal pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of setscrew with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M., state if driver or driven		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



WORM GEARING INQUIRY FORM

SPECIFICATIONS	GEAR	PINION
Quantity		
Material		
Heat treatment (if any)		
Number of teeth or threads		
Circular pitch		
Diametral pitch		
Pitch diameter		
Teeth, right or left hand		
Angle, normal pressure		
Tooth form, standard or stub		
Keyway size, if desired		
Setscrew size, if desired		
Location of setscrew with keyway		
Style of gear, plain, webbed, or spoked		
R.P.M. of worm		
Horsepower to be transmitted		
Type of drive, constant or intermittent		
Nature of load, steady or impulsive		



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The Business End of a Small Shop

Nearly twenty years ago *American Machinist* published a series of articles on small shop problems that was unusually popular. Recently we ran over the subjects covered in these articles and then asked several hundred of our readers who are operating small shops which of these subjects are of as much importance today. Upon their answers and comments we have based a new series of like articles of which this one is the first. We shall endeavor to have one of these in every number

FRED H. COLVIN

Editor, American Machinist

IN RUNNING a small shop as in running a small farm, the owner must be a good mechanic, or farmer, and a good business man as well. And this is a combination that is not easy to find. Some of our best mechanics are babes-in-the-wood when it comes to handling business details. Generally speaking such men should work for some concern which appreciates their ability or else combine with someone with at least ordinary business ability. A few business details can consume more time of the expert mechanic who loathes them than many jobs on which he could make both reputation and profit.

Unless a mechanic has had some experience in bookkeeping and in business practice generally, it will probably be better for him to arrange with a bookkeeper to work for him a few hours a week until his business gets to the point where he can have his own bookkeeper.

The expense of bookkeeping can be kept at a minimum by using as simple a system as possible. The cost of material entering into each job is essential as well as the cost of labor required to do it. This may or may not involve the use of time cards, depending on the kind and the size of the job. In most cases time cards are desirable as a record in estimating future jobs as well as keeping tabs on the ability or sincerity of the different men. They can be very simple or quite elaborate, and they should be designed so as to take as little time as possible to make out and simple enough to prevent errors.

Purchasing materials is quite a problem in itself, even in a small shop. It is essential to know where steel of various kinds can be obtained in the size and quantity likely to be needed, promptly and at a fair price. It is even more important to know about other materials because they are frequently more difficult to locate than steel. There are many grades of brass, for example, which come in different tempers. The gages used and weights of each must be known to avoid confusion. It is necessary to know, for example, that brass, bronze and copper are ordered by one gage, and that zinc sheets and steel sheets each have a different gage of their own.

It will pay to get acquainted with the men in houses that supply the materials you are likely to use. A personal contact helps greatly in getting material that is somewhat out of the ordinary. It also helps on the question of credit if that becomes desirable, as is frequently the case.

Better Buy Standard Parts

Small shops are frequently asked to build special machines or instruments. Some of these machines require special parts such as springs, screws, handles, gibs or other adjuncts. It saves a lot of time to know where these parts can be secured and what they will cost. This knowledge may mean getting a contract because of promptness while the other fellow is trying to find out who makes some special part. A knowledge of materials and supplies gives a customer confidence in the shop. Almost any shop can make small gears, handles and springs, but they can usually be bought for less money and at a saving in time in completing the machine. It is also well to remember that steel shafting can be bought ground to a thousandth tolerance, or less; that drawn steel is available in a variety of shapes, also to close limits; that some shops specialize in doing centerless grinding for the trade and that other facilities are available.

Small Shops Should Cooperate

Cooperation between small shops or all shops in any given locality can be mutually beneficial. It would be foolish for each shop to put in a planer big enough to handle the maximum sized job, as such machines would stand idle much of the time. Some shop, even one of the larger plants, probably has a large planer that would be available for all the work in the neighborhood. One shop may have a good miller or gear cutter and the next be better equipped with turret lathes or drills. It will pay all the shops to know just what equipment is in the shops of competitors. This will help everyone decide when, and whether, to farm out part of his work. It will also give him a line on the methods that each shop would use if they built the whole machine which may effect the method of estimating.

Standardize Cost Distribution

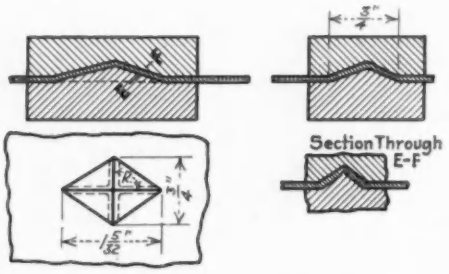
Even more important than a knowledge of equipment in the other fellow's shop is an assurance as to how costs are figured. In too many shops the owner does not figure his wage for supervision, or management, as part of the cost of a job. Others neglect interest on the investment and depreciation as a part of overhead. Some simply count the cost of material, and labor and add a fixed percentage that is supposed to include all overhead and profit.

Small shop owners can do themselves a good turn by getting together on the methods of keeping accounts and figuring costs. Each may have some pet hobby as to details but they should have some sort of an understanding as to fundamentals. It is easy to fool one's self on figures as to profit. Omitting some item of cost may cause too low a bid and not only cause loss to the individual shop but arouse unwarranted suspicion in the customer's mind.

No matter how the costs are figured they must include material, direct labor, supervision, interest on investment, maintenance, depreciation, overhead (such as taxes, insurance, bookkeeping, letterheads, bill heads, truck, power, light, janitor service and similar items) and profit. These will be gone into in more detail in a later article.

Press Work Pressures

Series XI—*Embossing*

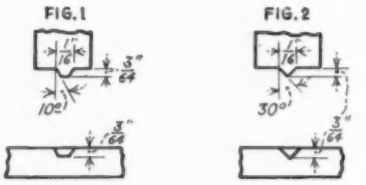


Material--Sheet steel, 0.075 in. thick
Operation--Emboss one diamond and bring ridges at R up sharp
Pressure--26,000 lb.
Test made in testing machine

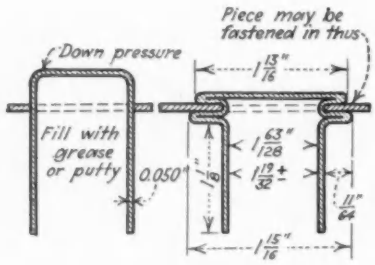
Embossing is often confused with coining. Strictly speaking, embossing is the raising of bosses or protuberances on a surface. When the embossing operation is carried to the point that a clear, sharp impression is produced, particularly at corners, coining also takes place.

When only embossing is being done, the speed of operation is of small importance. Standard speeds of press rams are not great enough to cause the metal to tear. The throated type of press is not desirable for embossing because this type has a tendency to spring. The impression will be sharper on the portion produced at the back of the throat. A straight-sided press should be employed; otherwise, an over-size gap press. Overloading of embossing presses is often caused by the use of worn dies.

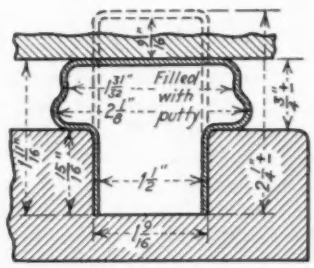
An example of pure embossing is the production of automobile license tags with a rubber punch. This method is satisfactory for 22-gage metal or lighter. The life of such a punch is about 40,000 tags. Replacement is made cheaply and quickly. Pressures vary from 100 to 400 tons for a six-figure plate. Much trouble has been experienced by persons engaged in this or similar work because properly compounded rubber was not used. The writer has witnessed much improvement in this material, and now finds that properly made rubber requires no more pressure than a metal punch.



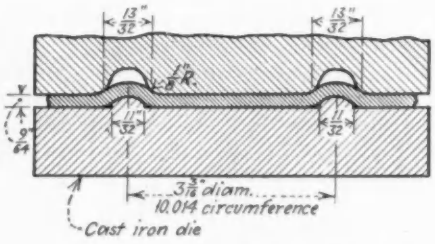
Material--Soft sheet brass and steel
Operation--Stamp like Fig. 1:
A. Steel, 1/32 in. deep
B. Steel, 3/64 in. deep
Stamp like Fig. 2:
C. Soft sheet brass, 1/32 in. deep
D. Soft sheet brass, 3/64 in. deep
E. Soft cast brass 3/64 in. thick
F. Soft steel, 3/64 in. deep
Pressure--A. 12,200 lb.
B. 14,000 lb.
C. 7,800 lb.
D. 11,500 lb.
E. 10,400 lb.
F. 12,800 lb.



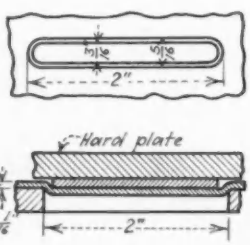
Material--Low carbon steel shell, 0.050 in. thick
Operation--Bulge
Pressure--20 tons



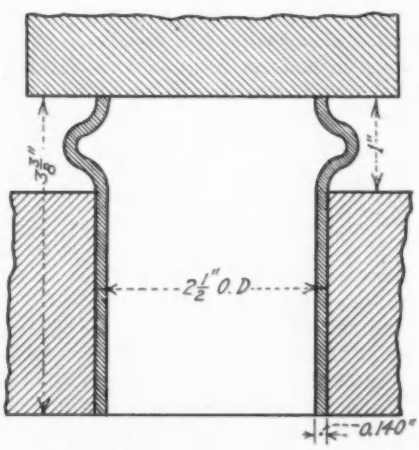
Material--German silver, 0.050 in. thick
Operation--Bulge
Pressure--18 tons



Material--Soft machine steel, 9/64 in. thick
A. 9/64 in. thick
B. C. and D., 0.05 in. thick
Operation--Emboss circular bead as follows:
A. 9/64 in. high
B. 1/8 in. high
C. 3/16 in. high
D. 1/4 in. high
Pressure--A. 51 tons
B. 8-1/2 tons
C. 15 tons
D. 20 tons
Metal broke when embossing 1/4 in. high
Tests made in testing machine



Material--Sheet steel, 1/16 in. thick by 5-1/2 in. square
Operation--Form as shown
Pressure--12,000 lb.
Test made in testing machine



Material--Low carbon steel tube, 0.140 in. thick
Operation--Bulge without filling
Pressure--82,000 lb.

Contributed by C. W. LUCAS

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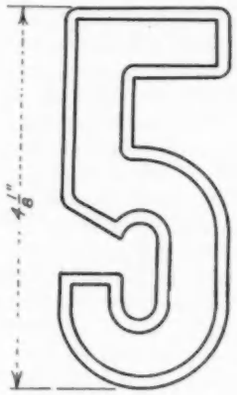
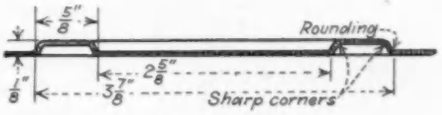
Press Work Pressures

Series XI—*Embossing*

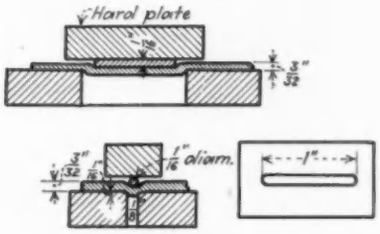


Material--Steel - A. 0.023 in. thick
B. 0.028 in. thick
C. 0.034 in. thick
D. 1/16 in. thick, embossed 1/16 in.
Operation--Emboss a figure 3/32 in. high
Pressure--A. 8,000 lb.
B. 10,000 lb.
C. 12,000 lb.
D. 52,000 lb.

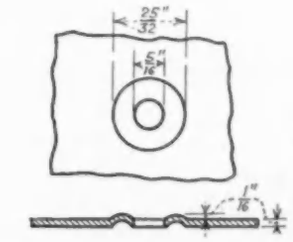
Material--Soft brass - A. 1/16 in. thick
B. 0.085 in. thick
Operation--Emboss a figure 1/16 in. high
Pressure--A. 26,000 lb.
B. 32,000 lb.



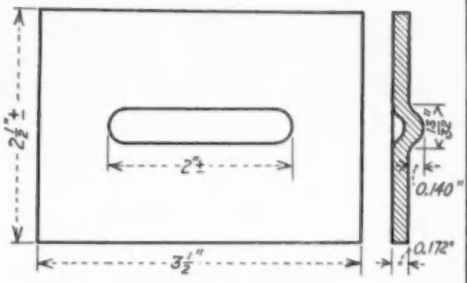
Material--Sheet steel, 10 in. square
Operation--Emboss ring in middle of sheet by stretching the metal
Pressure--13,000 lb.
Test made in testing machine



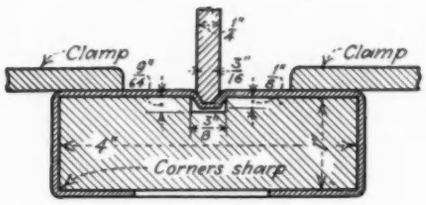
Material--Sheet steel, 3/32 in. thick
Operation--Emboss groove
Pressure--12,000 lb.
Test made in testing machine



Material--A. Low carbon steel, 1/16 in. thick
B. Brass, 1/16 in. thick
Operation--Emboss a hole
Pressure--A. 7-1/2 tons per hole
B. 14 tons per hole

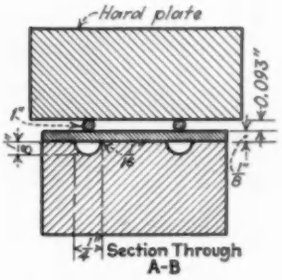


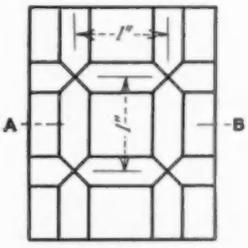
Material--Soft steel, 11/64 in. thick
Operation--Emboss groove
Pressure--30,000 lb.
Test was made in testing machine to ascertain the pressure required to stamp letters and figures in steel barrel heads

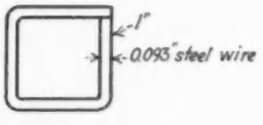


Material--Low carbon steel, 0.078 in. thick by 3 in. wide
Operation--Form a groove by stretching the metal.

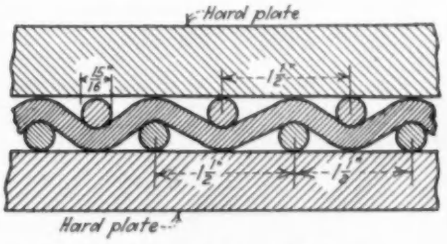
Pressure--20,000 lb.



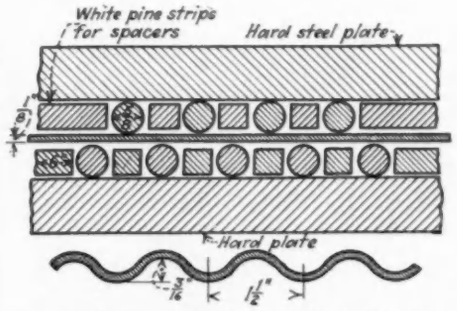




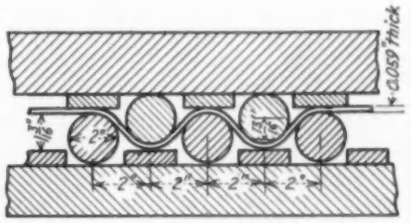
Material--Soft steel, 1/8 in. thick
Operation--Emboss a square groove
Pressure--30,000 lb.



Material--Machine steel, 1/4 in. round
Operation--Corrugate cold
Pressure--5 tons. 1 in. bar required 80 tons



Material--Machine steel, 1/8 in. thick by 3 in. wide by 6 in. long
Operation--Corrugate
Pressure--80,000 lb.



Material--Low carbon steel, 0.059 in. thick
Operation--Corrugate strip steel. The metal was allowed to pull in both ends
Pressure--6,000 lb.

Contributed by C. W. LUCAS

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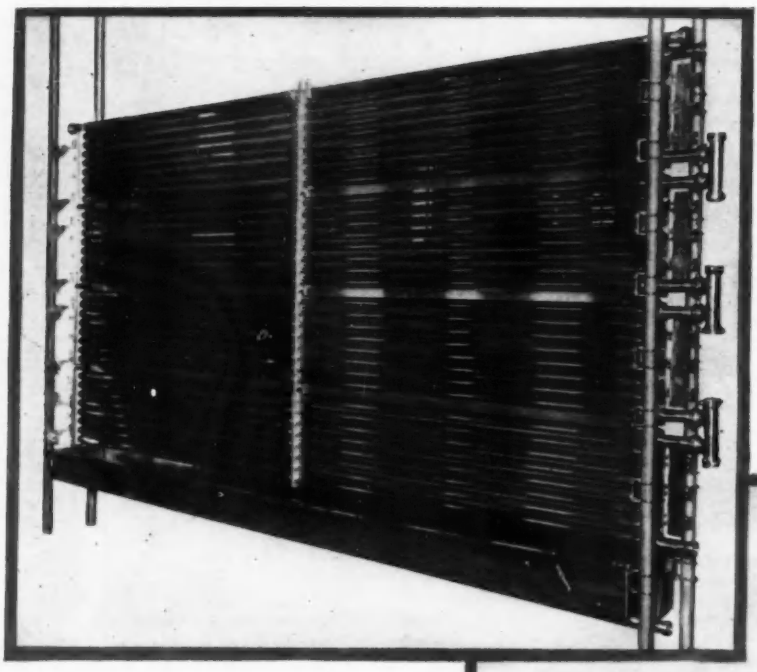
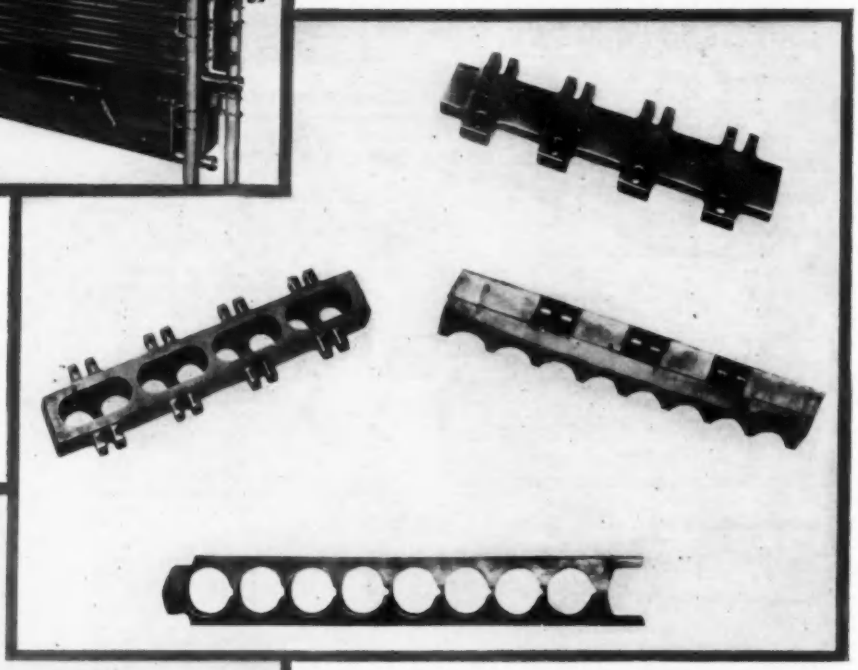
Soft Soldering

SOFT SOLDERING is used extensively in the manufacture of milk and other dairy equipment for obtaining strength and tightness of a joint or as a fillet for making sanitary corners. Examples are the sweating of tubing into headers, lock-seamed joints for light-gage linings in cheese vats, filling machine hoppers, covers and the like, or in the attaching of drip strips to the under sides of tubes.

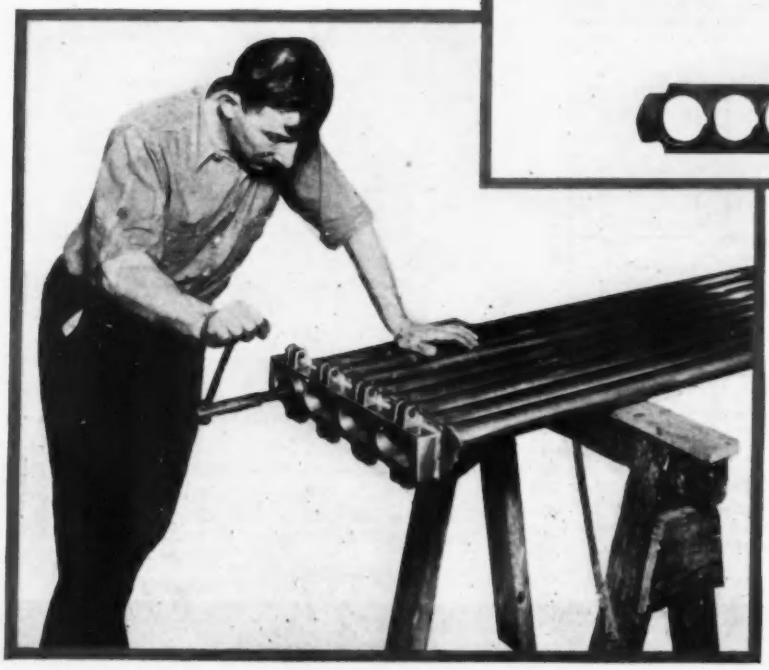
Inconel, the new nickel-chromium alloy developed especially for the dairy industry by the International Nickel Company, lends itself to any form of fabrication. It can be soft soldered like any of the older materials though a few important precautions should be observed. The first of these is to see that all metal surfaces to be joined are clean. Any oxide surface or discoloration due to previous welding or anneal-



Final assembly of a regenerating unit for cooling milk after pasteurization. The trough at the bottom is of all-welded construction



Above—Inconel castings used in the regenerator comprise cover plates for the headers, header castings and the center spacer castings



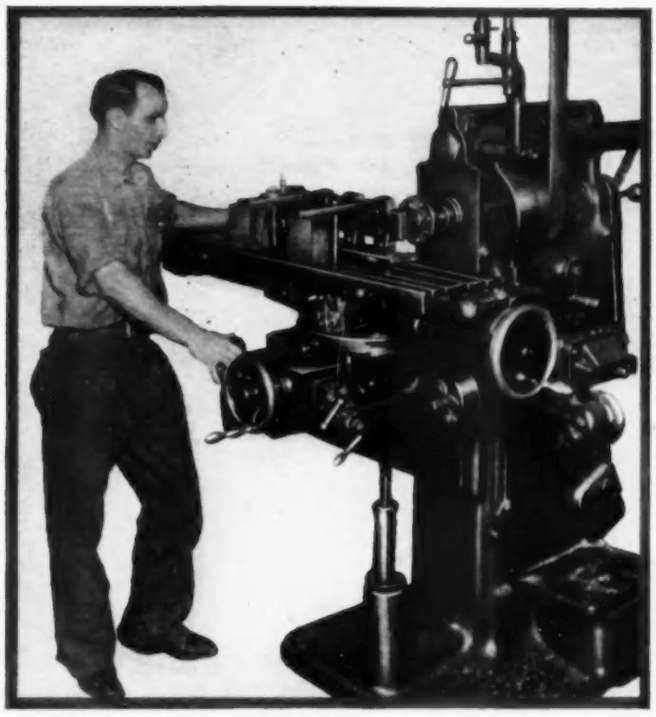
Left—Rolling in the Inconel tubes prior to sweating in the soft solder. Tube ends and the machined recesses in the casting are tinned before assembly

ing should be removed carefully, preferably with emery cloth.

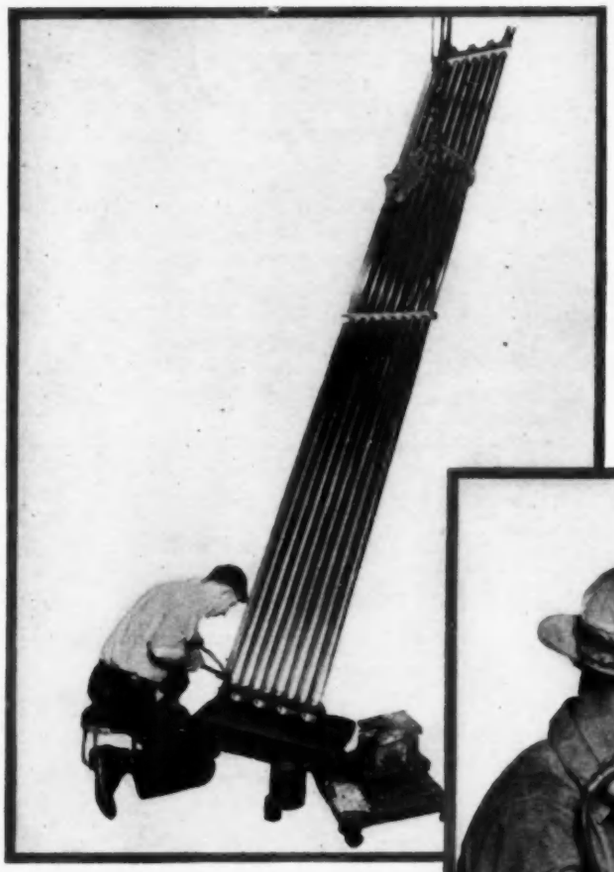
Where convenient the tinning of surfaces with a large soldering iron carrying medium heat is recommended before jointing. The soldering iron is preferable to a gas torch because with the latter there is always the danger of overheating. Once the surfaces are tinned, however, a torch may be used for the final flowing in of the solder.

Soft solders most generally used are the 50-50 or 60-40 tin-lead solders. When jointing drip strips to tubes a lower melting point solder is necessary while soldering the second side to prevent melting away the first soldered seam and fillets. It also is necessary to work a little more slowly to permit the heat to penetrate Inconel.

The illustrations show various operations in the manufacture of an Inconel regenerating unit for cooling milk after pasteurization. The photographs were taken in the plant of E. A. Kaestner Company, Baltimore.



Above—Machining Inconel castings. Inconel lies between Monel metal and stainless steel in machining characteristics



Left—Flushing, tubes and headers with solder to make the assembly completely sanitary

Polishing the inside of the tube headers. It is necessary to polish all inside and outside surfaces for dai·· use

• IDEAS FROM PRACTICAL MEN

Tools That Were a Failure
Discussion

C. D. HAEDRICH
Chief Draftsman, Artillery Department, Frankford Arsenal

Referring to the article by Forrest L. Johnson under the title given above (*AM*—Vol. 77, page 284), perhaps our experience in making hooks bent from threaded studs may be of interest. We make large quantities of these hooks from studs produced in an automatic screw machine.

At first, the studs were bent in the tools shown in Fig. 1. A stud was placed by hand in the groove *A* in the die with the plain end against the stop *B*. When the ram descended, the punch *C* bent the stud into a hook. On the upward stroke of the ram, the finished hook was removed and another stud was placed in the groove. Since we could make but 1,250 pieces per hour in these tools, and wanted to step up the production, the tools illustrated in Fig. 2 were designed to be used in a press that was inclined at an angle of 45 degrees.

In these tools the work is placed in the magazine *A*, being careful that the threaded ends are facing in the proper direction. When the ram is up, the distributing plate *B* is out of the way of the work, permitting the studs to roll down the magazine until the first one contacts with the raising pins *C*. The lifting pin *D* holds up the distributing plate when the ram is at the upper part of its stroke. When the ram is on its downward stroke, the distributing plate is released and goes down into place by the aid of spring *F*, and the raising pins are lowered by springs *H*, permitting the first stud in the magazine to roll down against a stop on the die while the distributing plate holds back the rest of the studs.

At this same downward stroke, the punch *I* bends the stud into a hook. On the upward stroke of the ram, the knockout pin *K* ejects the finished hook from the die and the raising pins raise up the next stud on the die, when it rolls into bending position. As the press is inclined, the ejected hook falls through at the back and into a container below. The small brass stops *L* are soldered to the die to prevent the studs from rolling too far. With these tools the production was increased to 3,750 pieces per hour.

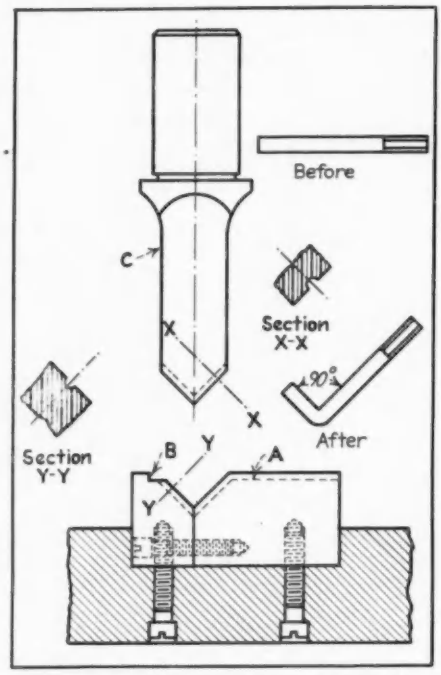


Fig. 1—This punch proved very satisfactory until they wanted more than 1,250 pieces per hour

CHARLES KUGLER

A regular faceplate having the bolt slots plugged up was fitted with a cut-off tool *A* and a bending tool *B*, part of the bending tool being cam shaped. Held in the toolpost was the block *C*. The rod was pushed through a bushed hole in the block *C* until it touched the faceplate ahead of the bending tool. When the bending tool came around, its cam surface struck the rod and pushed it back the correct distance for forming the bent end, and the flat part of the tool did the bending. After the bending tool had passed, the rod was advanced until the bent end struck the faceplate, and when the cut-off tool came around it severed the hook from the rod, leaving the shank of the correct length. As a last operation, the shanks of the hooks were threaded in a hand screw machine equipped with a self-opening die.

Feeding the rod at the proper intervals required a certain amount of skill on the part of the operator, but the production was surprising. In using this method, it would be well to paint the bending tool and the cutoff tool different colors so that the operator could distinguish them when the lathe was running. In time, the contact of the rod with the faceplate will wear a groove in the faceplae, therefore it would be well to attach a hardened ring to resist the wear. I do not know if the ends

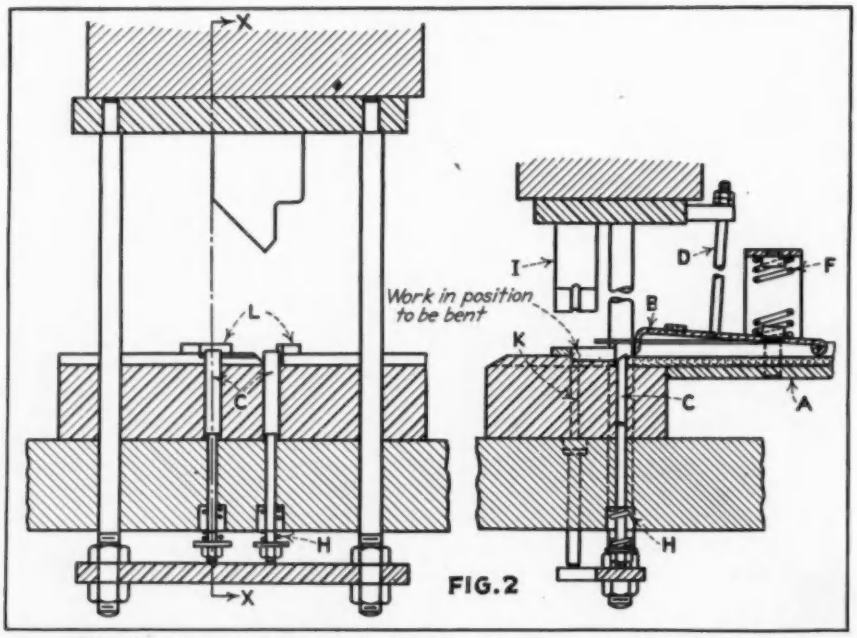
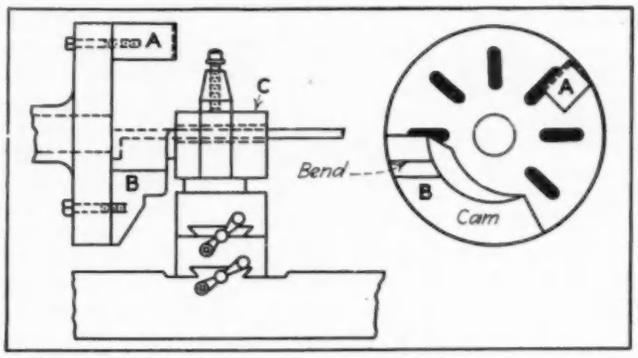


Fig. 2—By using this method and a magazine feed production was stepped up to 3,750 pieces per hour

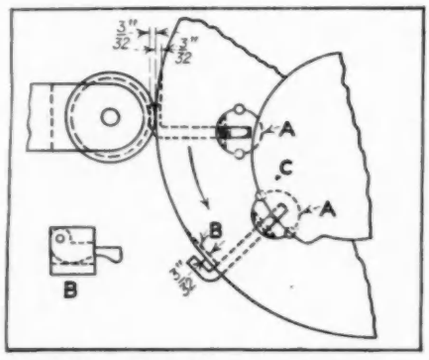


Here is another method of making the same hooks, using a lathe faceplate for cutting off and bending

of the hooks were accurately square with the shanks because I did not test them, but the squareness was not important in this case.

W. E. GOCHNAUER

From my experience, I don't believe Mr. Johnson went far enough in his design. If he had used a faceplate about 12 in. in diameter and put half-round tangent grooves at one side of the holes, as at *A* in the illustration, he would have been spared the chagrin of having the



Another faceplate method of bending, using a roller and ejector

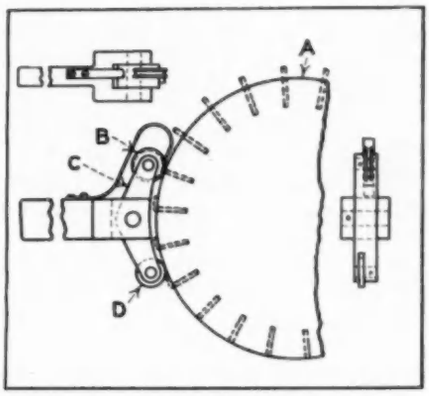
bent ends of the studs curved instead of straight.

I very much doubt if the bent studs would drop out of the hole by gravity alone. Therefore, I have sketched an ejector having a knockout trigger, as at *B*, one to be placed near the bottom of each hole. The trigger is operated by a stationary cam *C*, the shank of which is held in the tailstock spindle.

EMIL WITTMANN

It is my belief that if the tools had been made as shown in the accompanying illustration they would have done the work satisfactorily.

Equally spaced flats are milled around the periphery of the faceplate, as at *A*, a little of the curvature being left between the flats. The holes in which the work is placed are located in the centers



Spring controlled rollers vary the pressure to counteract spring of the stock

of the flats and may be drilled either radially or at an angle, determined by experiment to counteract the spring of the stock. The bending roller *B* is located at the upper end of the pivoted member *C*. The follower roller *D* is located at the lower end and rides upon the flats and the curves on the periphery of the faceplate, controlling the movement of the bending roller and its pressure upon the work.

As soon as bending takes place, the pressure of the bending roller on the work, as controlled by the follower roller, decreases gradually, thus eliminating ironing the bent ends into curves.

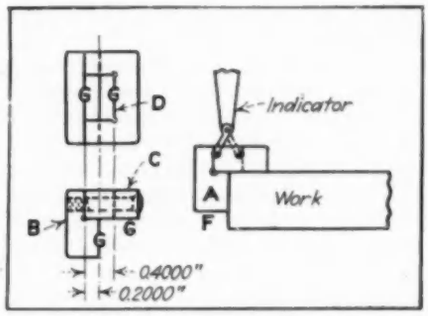
Setting a Jig-Borer Spindle Central With the Edge of Work

R. F. MOORE
Moore Special Tool Company, Inc.

It is sometimes necessary to locate and to bore a hole a given distance from the edge of the work. The first step is to accurately locate the spindle of the jig borer central with that edge. A gage for this purpose, to be used in connection with an indicator, is shown at *A*.

The gage is made in two parts held together by screws. Both parts are hardened and ground to gage blocks. Part *B* has a step 0.2000 in. deep, while part *C* has a groove of the same depth. When the parts are assembled, as at *D*, there is a rectangular opening 0.4000 in. wide.

The gage is held against the edge of the work and an indicator is placed in the spindle of the machine and is lowered into the rectangular hole. The spindle is revolved slowly by hand and



Gage for setting spindle central with the edge of the work

the table is moved until the indicator reads the same when the contact points touch both sides of the opening. The spindle of the machine is then bound to be accurately central with the edge of the work, and its position can be safely taken as a point of departure.

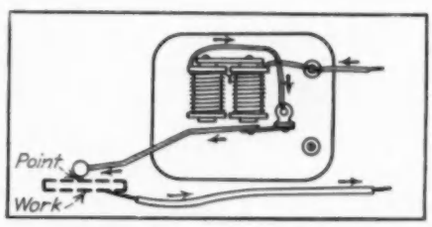
Credit for the idea is due to the operator of our jig borer. The gage is inexpensive to make, extremely accurate, and serves as a means for the fastest method we have yet known for the operation for which it is intended.

An Electric Etching Tool

L. KASPER

Some tools, such as micrometers, etc., cannot be marked by stamping without damaging them. Hardened parts, or tools, can be marked only by etching, either with acid or by the use of some form of an electric etching tool.

The sketch shows how an electric etching tool was made from a small electric bell by a slight change in the wiring. An ordinary house bell is used, taking the current either from a battery of dry cells or from a transformer. Twelve volts is sufficient. To change the bell into an etching tool, the vibrator contactor, the gong and the wire



Electric etching tool made from an ordinary electric house bell

connecting the vibrator support with the binding post are all removed. The wire leaving the magnet coils is attached directly to the vibrator support. The striking ball of the vibrator is drilled and a pointed metal pin is inserted. One wire from the source of supply is attached to the binding post nearest to the magnets and the other wire is held in contact with the work to be etched.

To operate the tool, the bell box is grasped between the thumb and the index finger of the right hand, in much the same manner as in holding a pencil, and the point in the ball is guided over the work, the process being exactly as when writing with a pencil, though, of course, much slower and with a much lighter touch. When the pin in the ball is brought into contact with the work, the current passes through the magnet coils, through the vibrator, through the work and back through the wire in contact with the work to the source of supply. When the magnets act to attract the vibrator, the pin is lifted out of contact with the work, breaking the circuit. As the circuit is broken, an electric arc is formed between the pin and the work, the heat of the arc causing a series of small pit marks to be formed on the surface of the work. Although the pit marks are not very deep, they are quite distinct, and any etching done in this manner will be quite durable.

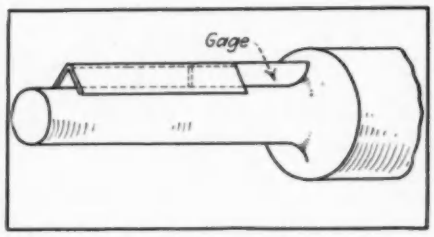
Instead of the short pin in the vibrator ball, the ball can be drilled through and a pin about an inch long can be inserted and locked by a setscrew. Thus the length of the contact point can be adjusted, making it possible to work in grooves or depressions, besides giving better visibility at the working point when following the lines.

Measuring a Fillet Radius

FRANK C. HUDSON

There was trouble recently with an inspector who didn't realize that in order to measure fillets accurately you have to hold the radius gage both parallel and radial with the axis of the shaft. After he rejected several pieces that were perfectly good, the lathe man fixed up a gage that wouldn't let him make a mistake.

He got a piece of steel angle and had the insides milled parallel and with straight edges. Then he slit the angle and put the radius gage in it as shown. This is almost identical with the old-time key seat rule we used to have to lay out key seats on shafting, before chipping them out, or even after we used the shaper or planer, and perhaps the miller.



Fillet gage that resembles the old keyseat rule plus a radius blade

With this gage the inspector had to pass the shaft he had previously rejected. Incidentally we found that the fillet he was so fussy about didn't fit anything but air and was merely a crack-preventer. A variation of a $\frac{1}{8}$ in. would have made no difference.

SEEN AND HEARD

JOHN R. GODFREY

Cast Iron Grows With Heat

We have known for a long time that cast iron grows in volume with repeated heatings. Alexander Outerbridge of Sellers made quite a study of it about half a century ago. Recent tests were made of 12-in. bars heated 35 times to 1,500 deg. F. and held for 45 min. at each heat. They were cooled for 15 min. after each heat. The plain cast iron bar grew ½ in. in length. Bars with a high alloy of nickel, known as Ni-Resist, only lengthened $\frac{3}{32}$ in. with the same treatment. Both the foundry and the machine shop have to know a lot more about cast iron than they did a few years ago.

Decibels and Shop Noises

Time brings new units of measurement as well as new machines. Just now it is "decibels"—the unit of sound. The decibel, so one of my friends who is silencing transport airplanes so passengers can be comfortable when they fly, is the lowest measurement of change in loudness that an average ear can detect. The best Pullman trains rate at 70 to 75 decibels while the noise in a good office should not exceed 50 decibels. The unit "Bel" is named for Bell of telephone fame. Noise is believed to affect efficiency of workers to a serious extent. And just as we have improved lighting and ventilation in shops, so we are likely to pay more attention to noise, especially now that we have some kind of a yardstick for measuring it. The cutting and welding torch has cut out a lot of shop noises—perhaps we can find other methods that will make the shop of the future a model of quietness.

What Is a "Gyp?"

Labels are frequently misleading and dangerous. Makers of machines of various kinds warn customers against buying replacement parts made by others and have a habit of designating all such replacements as "gyp" parts. While this may be true in many cases there are exceptions as in the case of one maker of replacement axles and propeller shafts for autos and trucks. This maker realized that satisfaction to all concerned meant the using of materials at least as good as those put out by the builder of the car or truck. Testing the parts made by the original maker he selected high grade nickel-chromium steel and his products have given such satisfaction that he has not laid off a single employee nor reduced wages during the depression. Much of the time he has had to run two shifts. Although many would class him in the "gyp" category, the builders of cars and trucks might learn a valuable lesson from such a shop.

Single Spindle Honing

Shall we finish-ream all cylinder bores in a block at once or ream them one at a time with the same reamer? It is admittedly difficult to keep 6 or 8 reamers exactly the same size. Is the time saved by reaming all at once worth the cost? Opinions differ. To some degree the same question applies to honing, but not so much if all cylinders are reamed to one size. Some shops keep a single-spindle machine with a hone to bring any bore that may be small up to size. This is a sort of insurance but is not often needed.

Lubrication—Cost and Economy

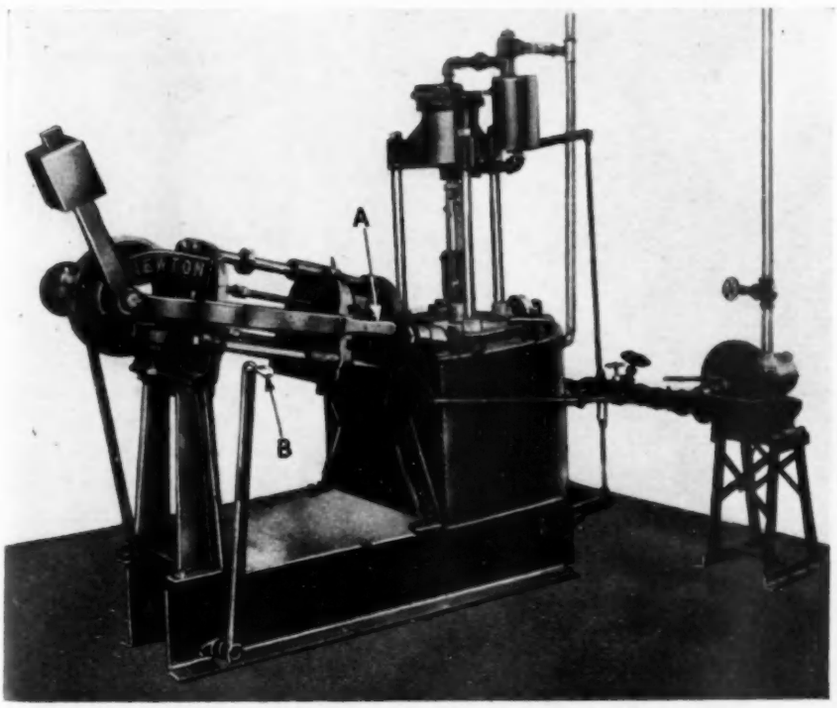
The cost of lubrication runs up into more dollars than most of us realize. One large rolling mill spends over $30,000 a year for lubricants, two-thirds of it for oil. This also includes the cutting compounds. But economizing in lubrication or in cutting fluids is a ticklish business. The railroads had a spell of oil economy about 35 years ago. Oil was limited to a given amount per hundred miles and locomotives *groaned* over many of the roads for thousands of miles. Shop men often contended that every dollar saved in oil cost ten dollars in repairs. And yet there are doubtless opportunities for real economies in nearly every plant. Systems that insure constant lubrication, without flooding and other wasteful methods, can save money in both oil and repairs. Lubrication is however a subject that must be handled intelligently and extreme saving is a doubtful experiment. The cost of one breakdown from a dry bearing will pay for a lot of oil.

SHOP EQUIPMENT NEWS

Newton-New Haven Die-Casting Machines

Hand-operated, semi-automatic and full automatic die-casting machines that employ the positive-plunger injection principle are being marketed by the Newton-New Haven Co., New Haven, Conn. These machines are suitable for short-run or continuous operation. On both the hand- and semi-automatic types there are two levers used for control and on the full-automatic only one. The semi-automatic machine is illustrated. Lever *A* is raised or lowered to open or shut the die, lever *B* is moved to the left to make a "shot," and is returned by a spring which at the same time operates the air valves to raise the injection plunger to the self-loading position. Casting speed is limited to the speed of the operator, but runs as high as 400 to 500 shots per hour on short runs or 600 to 700 shots per hour on continuous production. With the hand machine the production rates are somewhat lower, and with the automatic machine the rates are higher. All machines will take dies up to 9x12x9½ in., but smaller dies can be used. Die changes can be effected in 20 min.

All major castings used in the construction of these machines are of steel. Other stressed parts are of steel shapes or forgings. Welding is freely used. The furnace has a welded steel-plate shell lined with a non-shrinking refractory. In the hand and semi-automatic models the dies are closed by hand. In the semi-automatic model the injection plunger is operated by a cylinder that uses but one charge of air at 100 lb. per sq.in. pressure for both injection and plunger return and thus effects economy. These machines are shipped complete.



Newton-New Haven Semi-Automatic Die-Casting Machine which uses the same air for both injection and plunger return

"Semco" No. P13A Deep-Throat Punch Press

A 10-ton, welded-steel-frame press has been added by the Service Machine Co., 754 Broadway, Elizabeth, N. J., to its line of deep-throat punch presses. Designated as No. P-13A, this press is a high-speed machine operating at a maximum speed of 250 r.p.m. It is designed for medium punching and stamping operations, while its deep-throat design permits handling work of large area. The slide has a wide and deep bottom face with a hole for 1½ in. diameter shanks. Depth of throat is 8 in. as standard, but a special depth of 10½ in. can be had. The slide is 3½ in. from front to back and 7½ in. between the gibs. Width of the slide with bolt extensions is 16¼ in., and slide ways are 13½ in long.

The eccentric can be quickly interchanged for various lengths of stroke by removing the nut on the front of the shaft. Any stroke can be provided up

to a maximum of 1½ in. Standard stroke is 1 in. Adjustment of the slide is 2 in. With the standard stroke of 1 in. the maximum shut height is 7½ in. for the standard press and 12 in. for the special press.

The clutch includes a safety non-repeat cam that can be disengaged for nibbling work, and a reaction switch that insures silent operation of the clutch. Brake pressure is adjustable. The press has a base 26x34 in., a bolster area of 15x11 in., and a bed area of 15x11 in. on the P-13A press and 15x13 in. on the P-13 press. Distance from

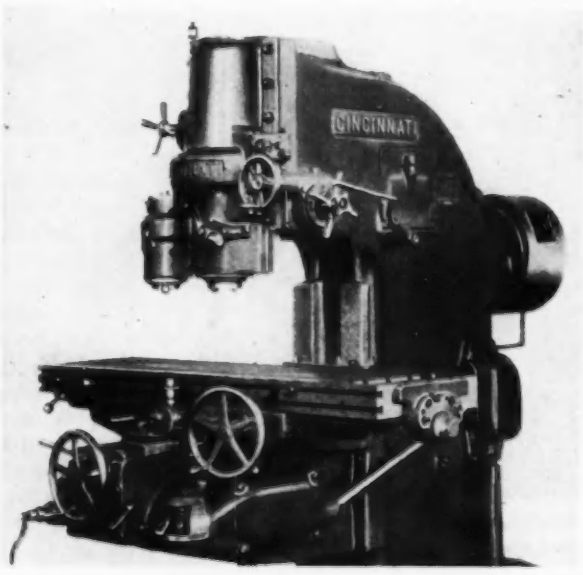
the floor to the center of the shaft is 60 in. Distance from the floor to the bed is 39 in. on the P-13A, and 35 in. on the P-13 press. Total weight, 1,600 lb.

Auxiliary Die-Sinking Spindle on Cincinnati No. 4 Vertical Milling Machine

The Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio, are now prepared to furnish the No. 4 vertical "High Power" milling machine with an auxiliary spindle mounted directly on the spindle head for the purpose of die-sinking. The spindle swivels, making it practical for use on dies in railroad shops. At the same time, the regular standard spindle with the National Standard taper hole, 3½ in. per ft., is available for regular vertical milling jobs.

The attachment is assembled on a boss cast integral with the regular vertical-head slide casting. Drive is obtained from the main spindle through bevel gears. The auxiliary spindle can be swiveled 90 deg. on either side of the vertical and has a special end 4 in. in diameter and equipped with a No. 11 B.&S. taper. A clutch disconnects the spindle when it is not in use. Distance between the auxiliary and the regular spindle centerlines is 8½ in. Sixteen spindle speeds from 17 to 480 r.p.m. are provided. The ratio between the main spindle and the auxiliary spindle is 1 to 1. A special handwheel is also furnished, located at the right front of the saddle, for moving the table longitudinally at the same rate as the cross-feed movement produced by turning the large handwheel at the front of the knee. The use of the two large handwheels makes it possible for the operator to follow the outline of the die accurately. The vertical head has a 6-in. hand vertical adjustment so that minor vertical settings of the spindles can be quickly made. Major settings are made by adjusting the machine knee.

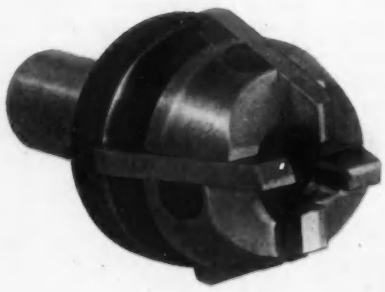
The machine illustrated is supplied with a 4 in. longer column than standard to give a 27 in. maximum vertical distance from the face of the spindles to the table. If the dies to be milled require different ranges than available on the standard machine, the column can be lengthened to give a 33 in. maximum vertical range, and the machine table can be lengthened to give 54, 60, 66, 72, 80 or 92 in. table travels. Table travels longer than 54 in. require a machine saddle longer than the standard and saddle supports down to the machine base.



Dies used in railroad shops are readily milled at the proper angle by application of an anxiliary swiveling spindle to the Cincinnati No. 4 High-Power Vertical Milling Machine

Genesee Adjustable Hollow Mill

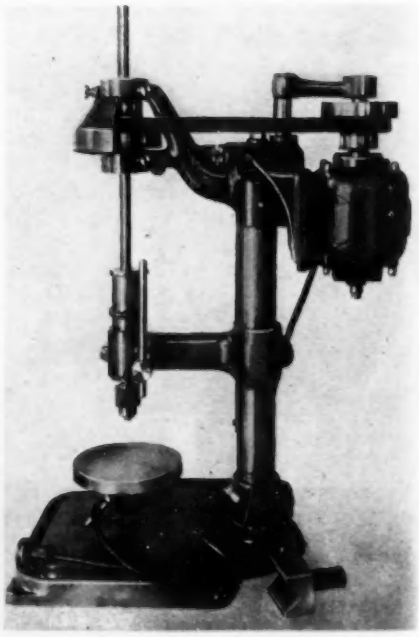
Two light-duty, adjustable hollow mills have been developed by the Genesee Manufacturing Co., Inc., Rochester, N. Y. The Style "L" tool has blades



set for brass and cast iron while the Style "M" has blades set at a 12-deg. cutting angle for work on steel. Both styles have the same adjustment, ⅛ in. The blades are locked and supported in heat-treated chrome nickel steel bodies. They can be removed for sharpening and replaced within one-thousandth of an inch. Each blade has a maximum of ¾ in. blade life. A half-turn of the lock screws release the blades for adjustment. Fifteen sizes are built. The smallest size has capacity from ⅛ to ¼ in. and the largest size from 1⅞ to 2 in. Four blades are used in all sizes.

Rex Sensitive Drilling Machine

Capacity of $\frac{5}{16}$ in. and normal speeds of 875 to 3,600 r.p.m. are specifications of the sensitive drilling machine announced by the Rex Machine & Tool Co., 9 Sheridan St., San Francisco, Calif. The spindle is supplied with a Jacobs chuck. Spindle speeds up to 8,000 r.p.m. can be furnished. The spindle is provided with two driving keyways placed opposite to balance the driving action. Drive is applied to a pulley mounted on a quill which is carried in the drill-head and which carries two keys corresponding to the splines cut in the spindle. Belt tension is maintained at the desired degree by means of a sliding car-



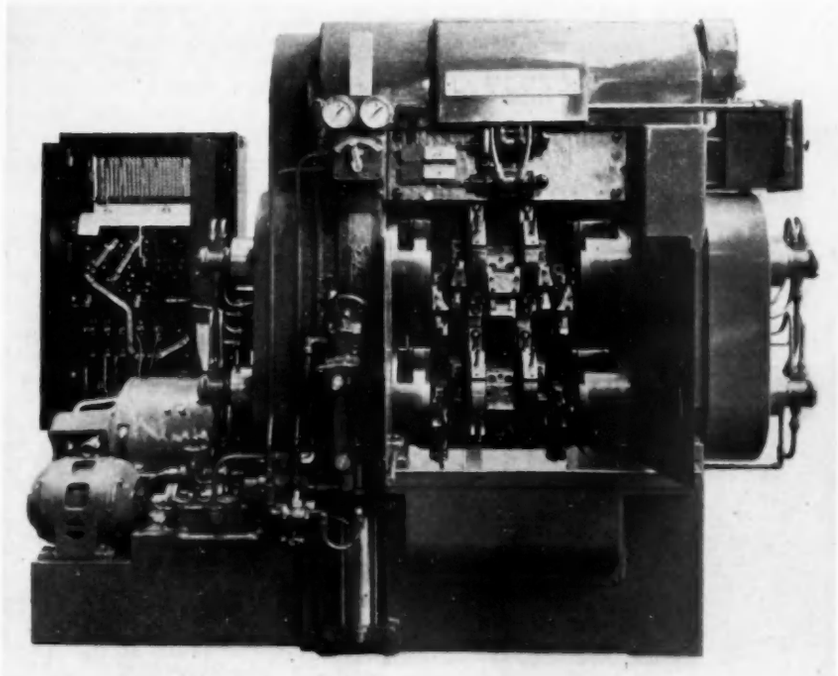
rier for the driving pulley bracket. A precision V-block enables the user to locate cylindrical parts directly on the vertical axis of the drill. The V-block is provided with a round shank which fits into the seat and can be swung around to any convenient position.

The machine illustrated is built with a table surface of 9x9 in. and outside base dimensions of 11¼ x 14½ in. A 6-in. circular table, mounted in a swinging arm with vertical adjustment, is also supplied. Quill travel is 2¾ in., and the clearance between spindle and column is 6 in. Vertical clearance 12 in.

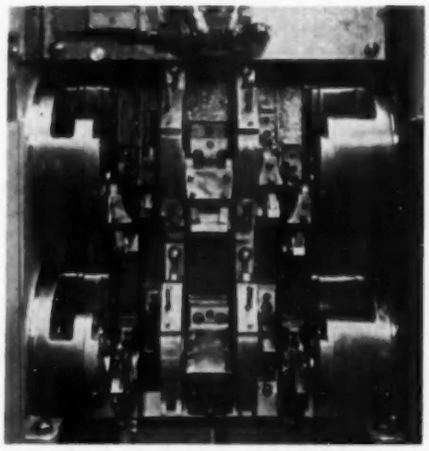
LeBlond Dual-Spindle Crankshaft Lathe

A development in the crankshaft equipment line produced by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, is a two-spindle crankshaft lathe with further refinements in design upon the single-spindle machine heretofore produced. This machine can be used either for facing webs of all pins on two crankshafts simultaneously or turning the pin bearings on two crankshafts simultaneously. The machine may be arranged for either single-end or double-end drive, according to requirements of torque developed by the turning operation. Single-end drive is shown, cranks being driven from the web adjacent to the flange end by oil-operated, pot-type chucks. The chucks are mounted on heavy forged-steel spindles, the radial and thrust reactions being carried by Timken precision bearings.

The stub end of the crankshaft in the single-end drive machine is supported by a heavy spindle carrying a roller-mounted hardened and ground sleeve which fits over the line bearing. Stub-end spindles are moved into position and returned by means of hydraulic control. Cranks are further supported on one or more center line bearings, depending of course upon design of the cranks, by heavy steadyrests. These are mounted on a cast-iron plate anchored to base of machine and held in alignment by two heavy steel tie-plates connected to the side column. Steadyrests are lined by replaceable cast-iron bushings, the lower half of the bushing being mounted in the steadyrest proper and the upper half in the cap. All caps are held in position by a toggle clamp which is Hydraulically operated and controlled by the same valves that actuate the stub-end support spindles. The sides of the steadyrest plates carry hardened and ground steel bearing plates which contact corresponding plates on the tool carriers. Tool carriers are large cast-iron plates hung between two large master cranks. The lower master crank carries the weight of the slides; and plates are connected to the upper crank by short connecting links. This construction prevents distortion which might be caused by expansion or contraction due to temperature changes. Tool carriers have hardened and ground steel bearing plates which slide on the adjacent unit, and are held in alignment by the steadyrest plates in the middle and tie plates on ends.



Front view of the LeBlond Dual-Spindle Crankshaft Lathe, including the remote-control electrical cabinet



Close-up showing the two sets of pot chucks, the tool block and tools, and the steadyrest

The tool blocks are arranged so that either horizontal or vertical tool units may be used. The tools are moved into the work by rocking the upper master crank upward. An oil cylinder in the front of machine actuates a rack which rotates an intermediate pinion on the drive side of lathe, which is connected on a cross shaft to an identical pinion on the tailstock side of lathe. The two intermediate feed pinions mesh with a rack fastened to the feed cams. These cams contact rollers mounted on the cradle, thereby rocking the cradle in and out for feed and return motions. The hydraulic system used on this machine is operated by two vane type pumps, one pump actuating the chuck and the second actuating the feeding mechanism. The oil circuit is so arranged that the combined volume of both pumps is used for rapid traverse. Feed may be any desired value at any part of the cut determined beforehand so that cams may be made to obtain the desired result. The motor is controlled through a dynamic switch reverse by which it is possible to stop automatically the spindle at any pre-determined position. Control circuit is interlocked with the chucking valves.

Carboloy Grade 300 Truing Tool

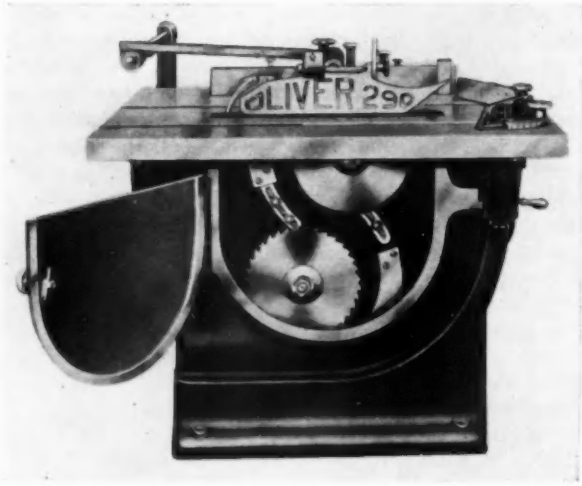
The Carboloy Co., Inc., 2481 E. Grand Blvd., Detroit, Mich., has developed a third grade of diamond-impregnated truing tool for finish dressing of grinding wheels. This Grade 300 tool has the best quality stones to accommodate the more difficult dressing jobs. A further development is the subdivision of each grade into three groups based on the mesh size of the diamond particles used. This choice of mesh sizes increases the range of work which can be

done by any particular grade and in many cases enables the user to apply successfully a lower-priced grade than would be possible if only one mesh size were available. The truing tool consists of a hard matrix throughout which a large quantity of diamond particles have been distributed.

Heald No. 48 "Borematic" Precision Boring Machine

Smaller than other "Bore-Matics", but entirely automatic in operation, the No. 48 machine has been added to its line by The Heald Machine Co., Worcester, Mass. The bridge is narrower than on the larger machines and accommodates a maximum of two boring heads. It is also shorter from left to right, so that the boring heads used are shorter than the types used on the No. 46 and No. 47 machines. Boring head drive is from the opposite end of the motor shaft by means of a multiple V-belt. With various combinations, the speed range covers 625 to 3,600 r.p.m., using an 1,800-r.p.m. motor. When a 1,200-r.p.m. motor is specially fitted, the speed range is 425 to 2,400 r.p.m. Three sizes of "Red Head" boring heads are available. Maximum and minimum center distances between heads of the standard type, when two are mounted on the bridge, are 10 and 5⅜ in. respectively. There is ample room for locating fixtures on a finished pad 9 in. wide by 22 in. long on top of the table. Two T-slots run longitudinally through the table.

In addition to the stop and start mechanism, the control box houses two practically identical units that control the boring and facing feeds. These units can also be used for two different boring operations. If necessary, a third unit can be added to give a third cutting feed to the table. The table has a dwell at the extreme "in" position to give the spindle time to stop before the table starts back to its loading position. The table is hydraulically operated on the boring stroke and returned by a gravity mechanism.



A revolvable yoke holds the independently driven ripping and cut-off saws so that either one can be used if desired by operating a hand crank

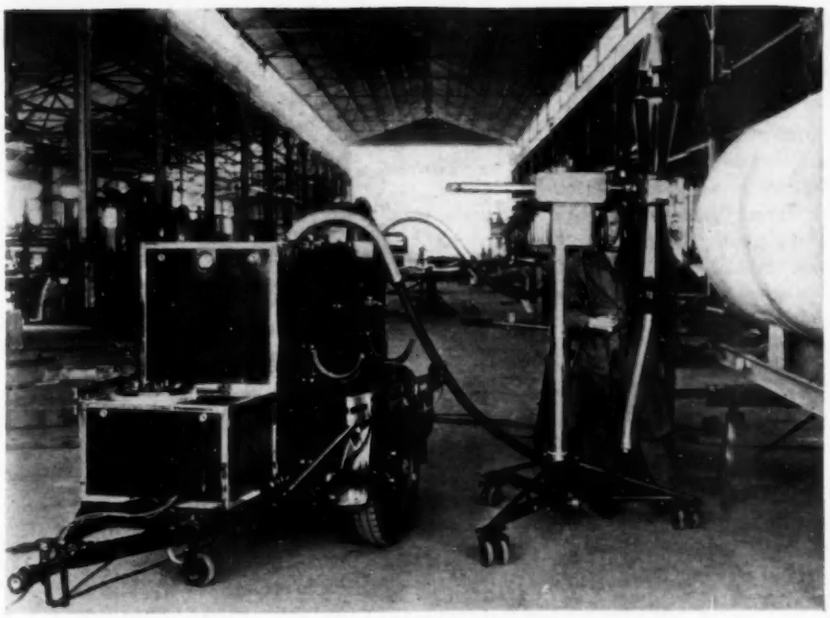
The Heald No. 48 "Bore-Matic" Precision Boring Machine is smaller than other machines in the line but has the same automatic features and is adapted to small shop use and to a single set-up in high production lines

Oliver No. 290 Double-Arbor Tilting Saw Bench

A motor-on-arbor-type tilting saw bench has been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. This machine is especially designed for pattern shops where quick changeovers from ripping to cutting are desired. The illustration shows a door swung open to show the two saws and the two splitters. The saw yoke unit is easily revolved by a hand crank. Two shaftless motors are employed, one on each of the two saw arbors. The yoke is held in a tilting frame and suspended so that at any position between the square of 90 deg. and the maximum angle of 45 deg., either one of the saws can be brought into action. The table always remains horizontal. A combined electric and mechanical brake stops the saws as soon as the current is shut off. The two arbors carry 12 in. rip and 12 in. crosscut saws which will cut to a depth of 2¼ in. Ripping capacity is 25½ in. The regular plain table measures 36x44 in., with a 10 in. wide auxiliary extension table. The table is graduated to the right of the saw for 22 in.

Metalix Portable X-Ray Equipment

Industrial X-Ray Corporation, 665 Chamber of Commerce Bldg., Los Angeles, Calif., has made an agreement with the N. V. Philips Corporation, Eindhoven, Holland, whereby the former now manufactures a portable industrial equipment. Available in three sizes, the "Metalix" apparatus, besides being portable, has the advantage that the primarily useful beam of the X-ray is employed, and that biologically harmful rays, that might be harmful to the operator, are absorbed at the source.



Mounted on a two-wheel trailer, this "Metalix" No. 200 Portable X-Ray Equipment is shown being used to examine a welded tank in a Western shop

The "Metalix" No. 200, illustrated, like the smaller sizes, can be connected directly to a 220-volt a.c. outlet or to a 440-volt power main. The apparatus consists of three components: A high-voltage generator housed in a metal container; a control box, and two shock-proof, high-voltage cables connected to the "Metalix" tube. The following materials may be examined: Iron up to 3½ in. thick (with special apparatus up to 4 in.); copper, bronze and brass up to 2½ in. thick, and aluminum up to 10 in. thick. Objects, such as cylinders, shafts, axles, pistons, and other parts, may be radiographed with this apparatus.

Société Genevoise Type VE-6 Optical Gear Tester

Designed for rapid, routine work, an optical gear testing machine for measuring both the pitch and eccentricity of small gears has been placed on the market in the United States by the R. Y. Ferner Co., Investment Building, Washington, D. C., agent for the Société Genevoise d'Instruments de Physique, Switzerland. This equipment differs from most projection instruments in that it does not project an image of the teeth of the gear, but throws on a graduated screen a rectangular shadow of a signal plate, by which on the horizontal ordinate of the screen one reads the variations of eccentricity and on the vertical ordinate the errors of pitch.

Capacity of the apparatus is for gears up to a maximum of 4 in. in diameter and a minimum of 0.16 in. in diameter. Feelers, or the contact anvils, with which settings in the teeth are made, are regularly provided for modules of 0.5 to 2.0 mm. or for diametral pitches of 50 to 12 approximately. On request feelers can be supplied for diametral pitches up to 100 (module of 0.25 mm.), or for maximum diametral pitch of 10 (module of 2.50 mm.). Direct readings of divisions of the scales can be made to 0.0002 in. or estimated to 0.00005 in., the guaranteed accuracy being ±0.0001 in.

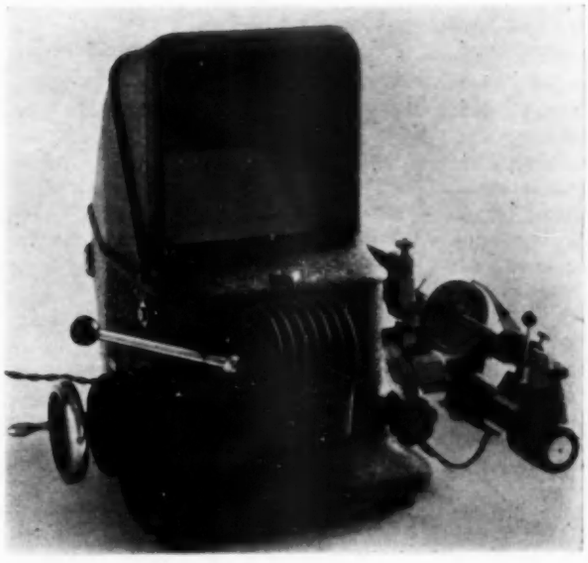
The gears to be tested are mounted on mandrels between the adjustable centers which are supported on a heavy cylinder. The position of the cylinder can be adjusted according to the diameter of the gear by rotation of a handwheel at the left of the instrument. There is also mounted on this cylinder a ratchet device operated by a Bowden cable by which the gear can be stepped around one or more teeth at a time.

A pair of interchangeable feelers are mounted on supports, to which a light spring pressure (2 oz.) is applied to engage them between the gear teeth. The upper feeler is fixed during the test and serves merely to index the gear. Pitch measurements are made by the movement of the other feeler with reference to the first. The second feeler is carried on a floating arm which swivels to right and left and tilts up and down without play. At the other end of this arm is carried a rectangular steel plate about 0.005 in. thick, with the edges lapped square.

Two adjusting screws serve to hold the signal plate in focus of a microscope with an objective of large aperture and a projection ocular. A condenser projects the shadow of the rectangular signal onto a mirror and from thence to the screen. The mirror is optically flat. The screen is shielded against direct light so that measurements may be carried out under normal lighting.

The arm that carries the optical signal and the lower feeler, being movable up and down about a central pivot, shows the variations in pitch. When swung to the right or left about the upper of two pivots, the same arm registers the variations in eccentricity.

The gear tester is suitable for gears used in fine machinery and clockwork



Gears from 0.16 to 4 in. in diameter and diametral pitches of 50 to 12 can be measured for pitch and eccentricity on the Société Genevoise Type VE-6 Optical Gear Tester

where accurate and silent gears are necessary, such as in meters, recording instruments, optical instruments, artillery sighting apparatus and motion-picture apparatus.

• TRADE • PUBLICATIONS

GEAR MOTORS. General Electric Co., Schenectady, N. Y., has published bulletin 1765 on its fractional-horsepower gear motors of $\frac{1}{6}$ to $\frac{3}{4}$ hp. capacity, single-phase, polyphase or direct current, 500 to 11 r.p.m.

GRINDERS. Catalog No. L-33 covers the Type C, 14-in. hydraulic universal grinders developed by the Landis Tool Co., Waynesboro, Pa. Important mechanisms are shown. Standard equipment furnished is listed.

LINESTARTERS. Leaflet 20499, describing the combination linestarters for squirrel-cage and wound rotor induction motors, is now available from the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MAINTENANCE WELDING. In a 16-age booklet "Oxwelding for General Maintenence," the Linde Air Products Co., 30 East 42nd St., New York, explains the application of the oxy-acetylene process to machine repair by welding, cutting and resurfacing.

METALLIZING PROCESS. A 20-page booklet has been prepared by the Metallizing Company of America, Inc., 1218 Long Beach Ave., Los Angeles, Calif., covering the metallizing process, or spraying of metals, its applications, advantages and accessory equipment. The applications cover each field, listing the object coated, the type of metal used and the purpose of coating. The booklet contains over 50 photographs.

NICKEL STEELS. A circular chart showing at a glance the nickel alloy steel compositions and heat-treatments required to develop yield points up to 175,000 per sq.in. in section sizes varying from 1 to 12 in. is available from the International Nickel Co., Inc., 67 Wall St., New York, N. Y.

ROLL GRINDING. Modern roll grinding practices are treated in a booklet entitled "A Treatise on Roll Grinding" offered by the Carborundum Co., Niagara Falls, N. Y. Its purpose is the reduction of roll grinding to a science and the removal of variables and the adoption of standardized procedure.

STAMPINGS. Examples of stampings produced in small lots at small cost with quick delivery are shown in the circular sent out by the Dayton Rogers Manufacturing Co., 1114 South Third St., Minneapolis, Minn.

TUMBLING AND BURNISHING. The Magnus Chemical Co., Garwood, N. J., has published a booklet "Tumbling, Rolling and Barrel Burnishing," completely describing and illustrating the various equipments and methods for performing these operations. The booklet contains 48, 5x8-in. pages.

• PATENTS •

JUNE 20, 1933

Metal-Working Machinery

Riveting Machines. Adin U. Kerns, Altoona, Pa. Patent 1,914,374.

Hydraulically Operated Machine Tool. Edward P. Burrell, Shaker Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,914,400.

Cam Grinding Apparatus. Warren F. Fraser, Westboro, Mass., assigned to Norton Co. Patent 1,914,561.

Work Driving Mechanism for Machine Tools. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,914,984.

Grinding Machine. Waldo J. Guild, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,914,995.

Combination Machine Tool. Klaas Van Wyngarden and James Sliekas, Chicago, Ill. Patent 1,915,139.

Tools and Attachments

Gear Cutter. Schuyler H. Earl, Rochester, N. Y., assigned to Gleason Works. Patent 1,914,411.

Work Clamp. James Syme, Johnstone, Scotland, assigned to Clifton & Baird, Ltd., Johnstone, Scotland. Patent 1,914,899.

Chuck and Loading Apparatus Therefor. William D. Schmidt, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,915,005.

Work Holding Device for Grinding Machines. John J. Holloway, New Britain, and Le Roy E. Linsley, Plainville, Conn., assigned to The Stanley Works. Patent 1,915,247.

JUNE 27, 1933

Metal-Working Machinery

Machine Tool with Reciprocating Carriage (Turret Lathe or the Like). Walter Mobius, Magdeburg, Germany, assigned to Magdeburger Werkzeugmaschinenfabrik A. G., Magdeburg, Germany. Patent 1,915,375.

Knock-Out Mechanism for Metal-Working Presses. Benjamin E. Irmis, Oak Park, Illinois. Patent 1,915,531.

Gear Polishing Machine. Thomas J. Mullen and Willard C. Powell, Dayton, Ohio, assigned to Oscar M. Poock, doing business as The City Machine & Tool Works. Patent 1,915,749.

Grinding Machine for Crank Shafts. Hans Jörgen Eriksen, Aarhus, Denmark. Patent 1,915,853.

Lapping Machine. Albert E. Robinson, Cincinnati, Ohio, assigned to The American Tool Works Co. Patent 1,916,117.

Lapping Machine. Albert E. Robinson, Cincinnati, and William G. Hoelscher, Norwood, Ohio, assigned to The American Tool Works Co. Patent 1,916,118.

Tools and Attachments

Tap Chuck. Axel G. Lundin and Carl W. Johnson, Brooklyn, N. Y., assigned to American Machine & Foundry Co. Patent 1,915,542.

JULY 4, 1933

Metal-Working Machinery

Apparatus for Grinding Gun Barrels and Cylindrical Surfaces. Marsden C. Hutto, Detroit, Mich., assigned to Hutto Engineering Co., Inc. Patent 1,916,267.

Clutch Mechanism for Punch Presses. Joseph W. Mathey, Struthers, Ohio. Patent 1,916,324.

Punch Press Mechanism and Automatic Stop Therefor. George H. Leland, Dayton, Ohio, assigned to The Leland Electric Co. Patent 1,916,379.

Synchronously Operated Punch Press. George H. Leland, Dayton, Ohio, assigned to The Leland Electric Co. Patent 1,916,380.

Broaching Machine. Charles Landers, Lansing, Mich., assigned to General Motors Corp. Patent 1,916,516.

Lathe. Frank O'Brien, Flint, Mich., assigned to General Motors Corp. Patent 1,916,581.

Automatic Feed Controlling Mechanism for Punch Presses and the Like. George H. Leland, Dayton, Ohio, assigned to The Leland Electric Co. Patent 1,916,845.

Control Mechanism for Machine Tools. Arthur F. Bennett, West Barrington, R. I., assigned to Brown & Sharpe Mfg. Co. Patent 1,916,914.

Grinding Machine. Clement Booth, Cincinnati, Ohio, assigned to The Heald Machine Co. Patent 1,916,917.

Tools and Attachments

Device for Rotary Cutting and the Like. John J. Buckley, Chester, Pa. Patent 1,916,253.

Apparatus for Truing Face Mill Cutters. Schuyler H. Earl, Rochester, N. Y., assigned to Gleason Works. Patent 1,917,103.